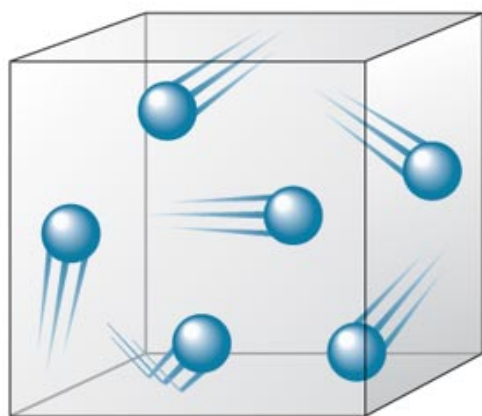
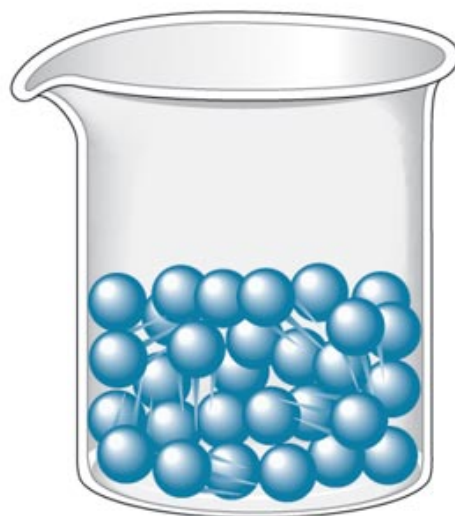


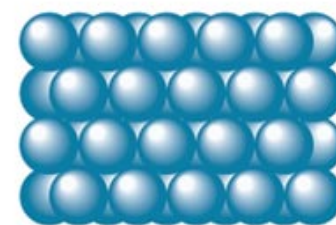
Figure 10.1 The Schematic Representations of the Three States of Matter



Gas



Liquid



Solid

Figure 10.2 a-b
(a) The
Electrostatic
Interaction of
Two Polar
Molecules (b)
The Interaction
of Many
Dipoles in a
Condensed
State

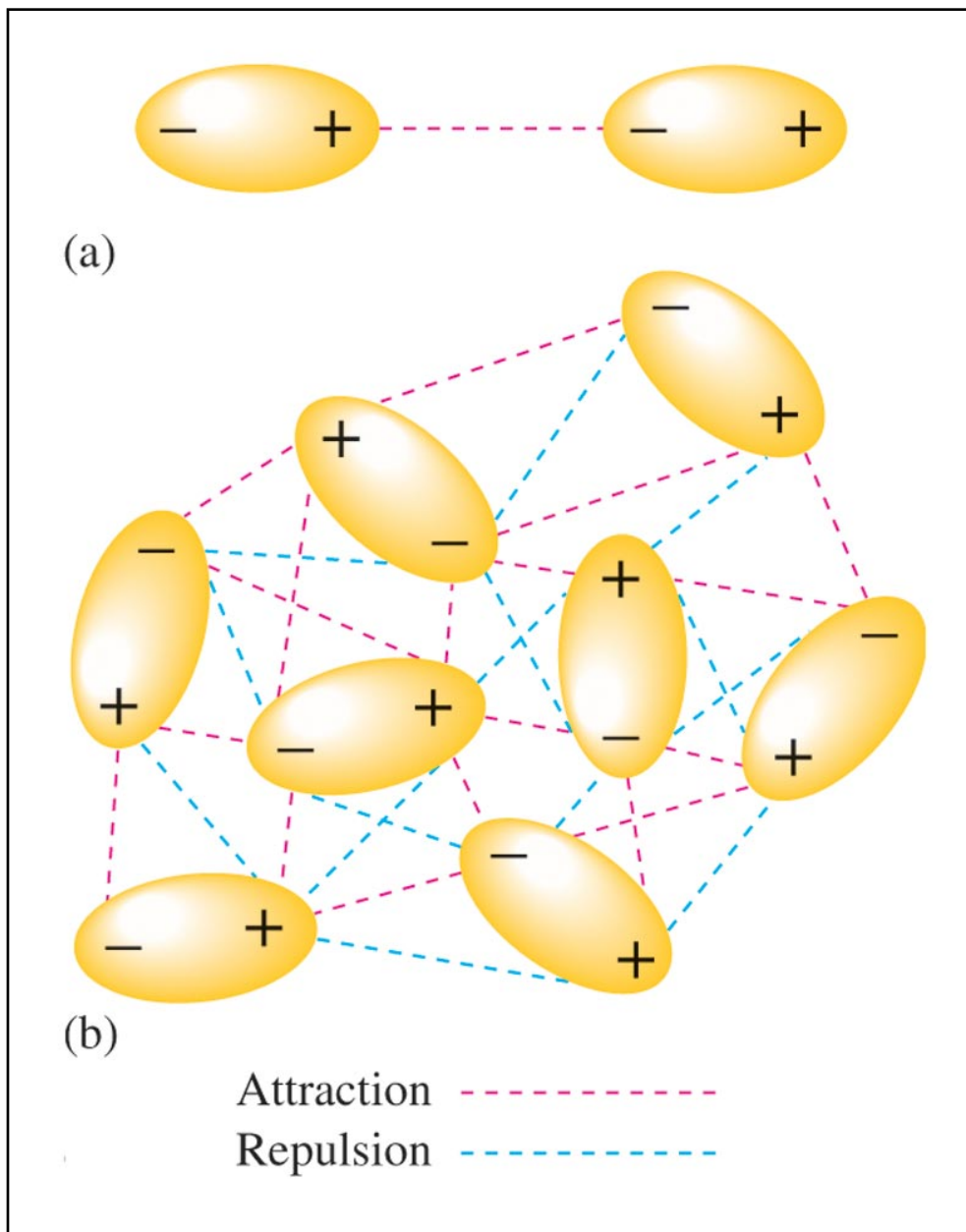


Figure 10.3 a-b (a) The Polar Water Molecule (b) Hydrogen Bonding Among Water Molecules

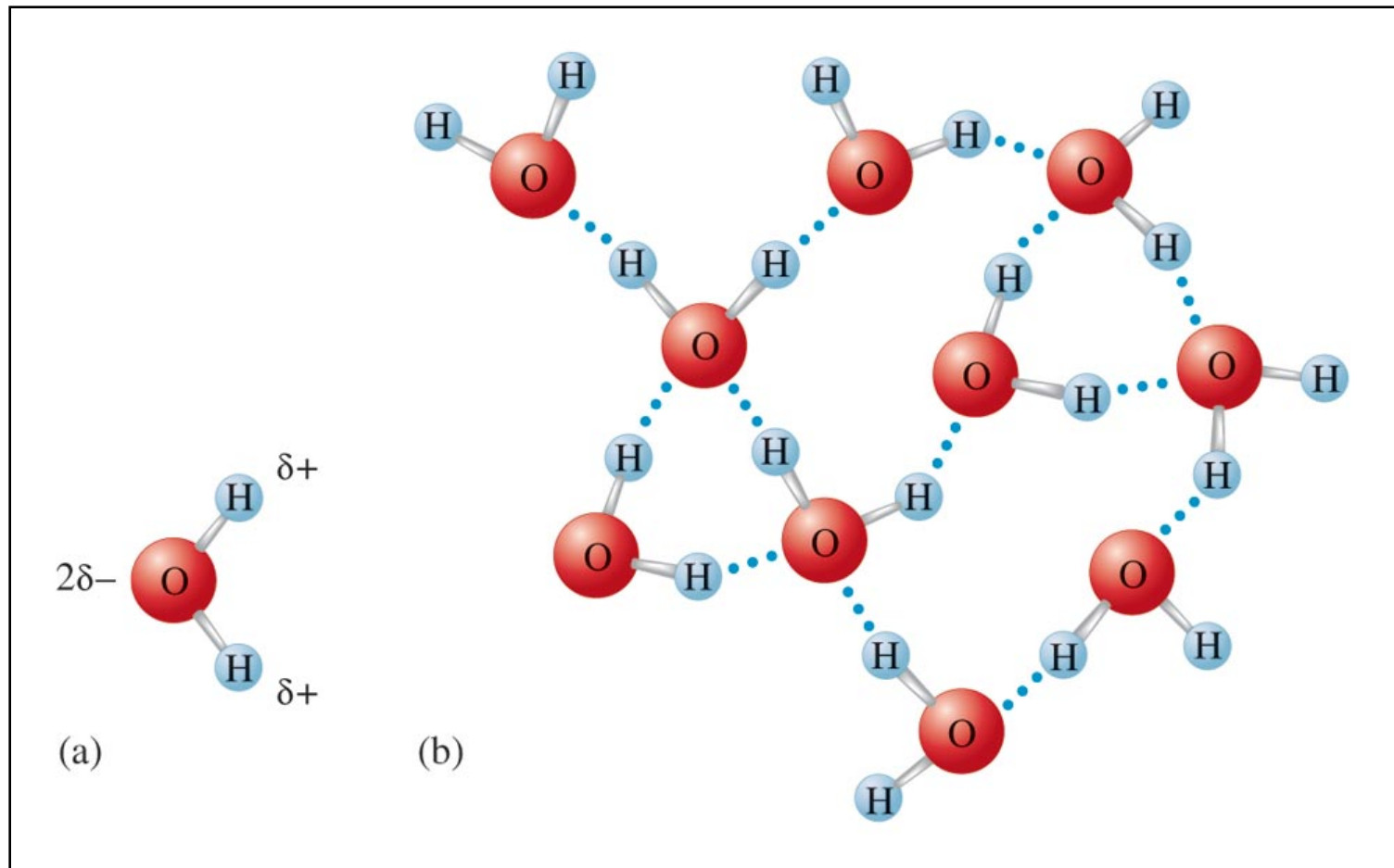


Figure 10.4 The Boiling Points of the Covalent Hydrides of the Elements in Groups 4A, 5A, 6A, and 7A

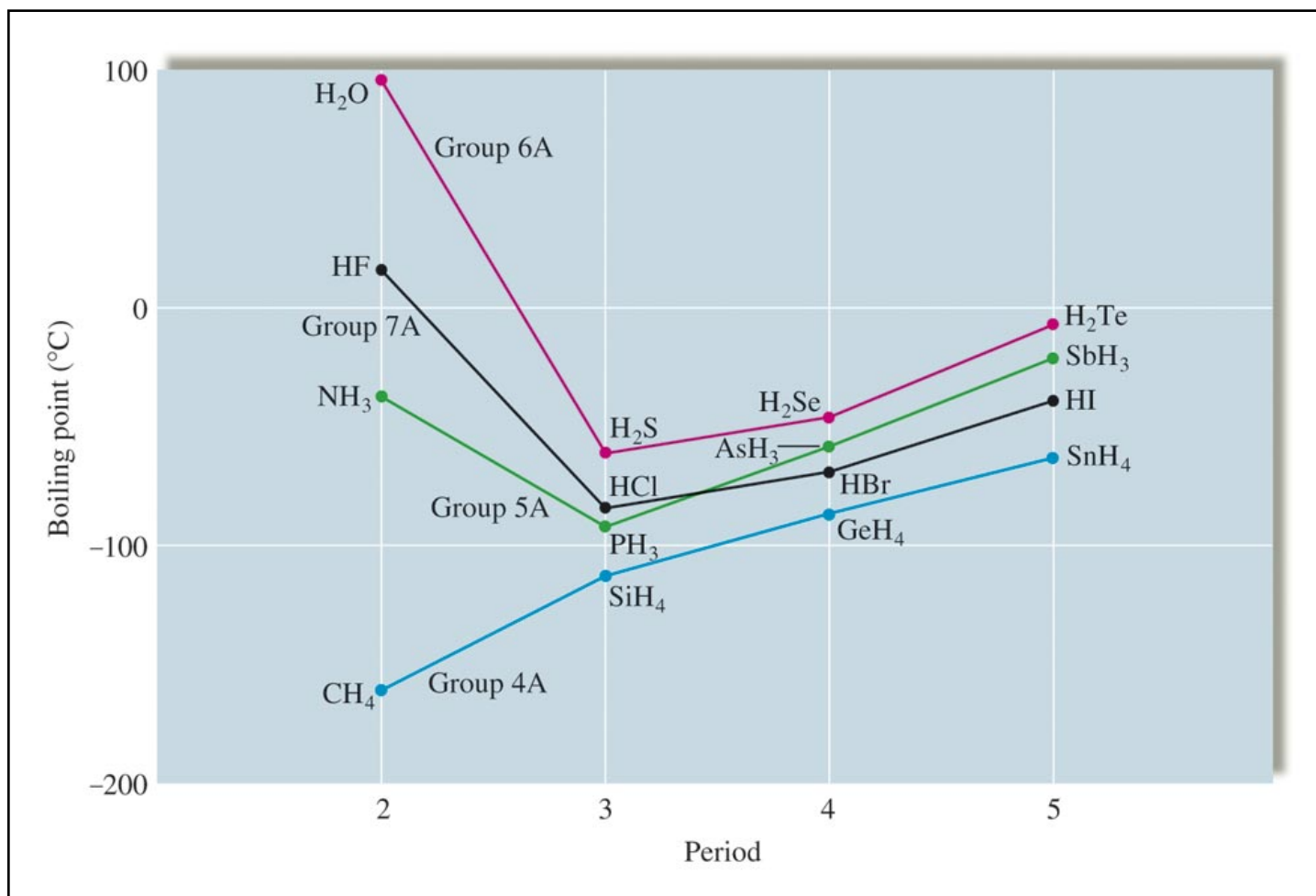


Figure 10.5
 (a) An
 Instantaneous
 Polarization
 can Occur on
 Atom A (b)
 Nonpolar
 Molecules
 Such as H_2
 also can
 Develop
 Instantaneous
 and Induced
 Dipoles

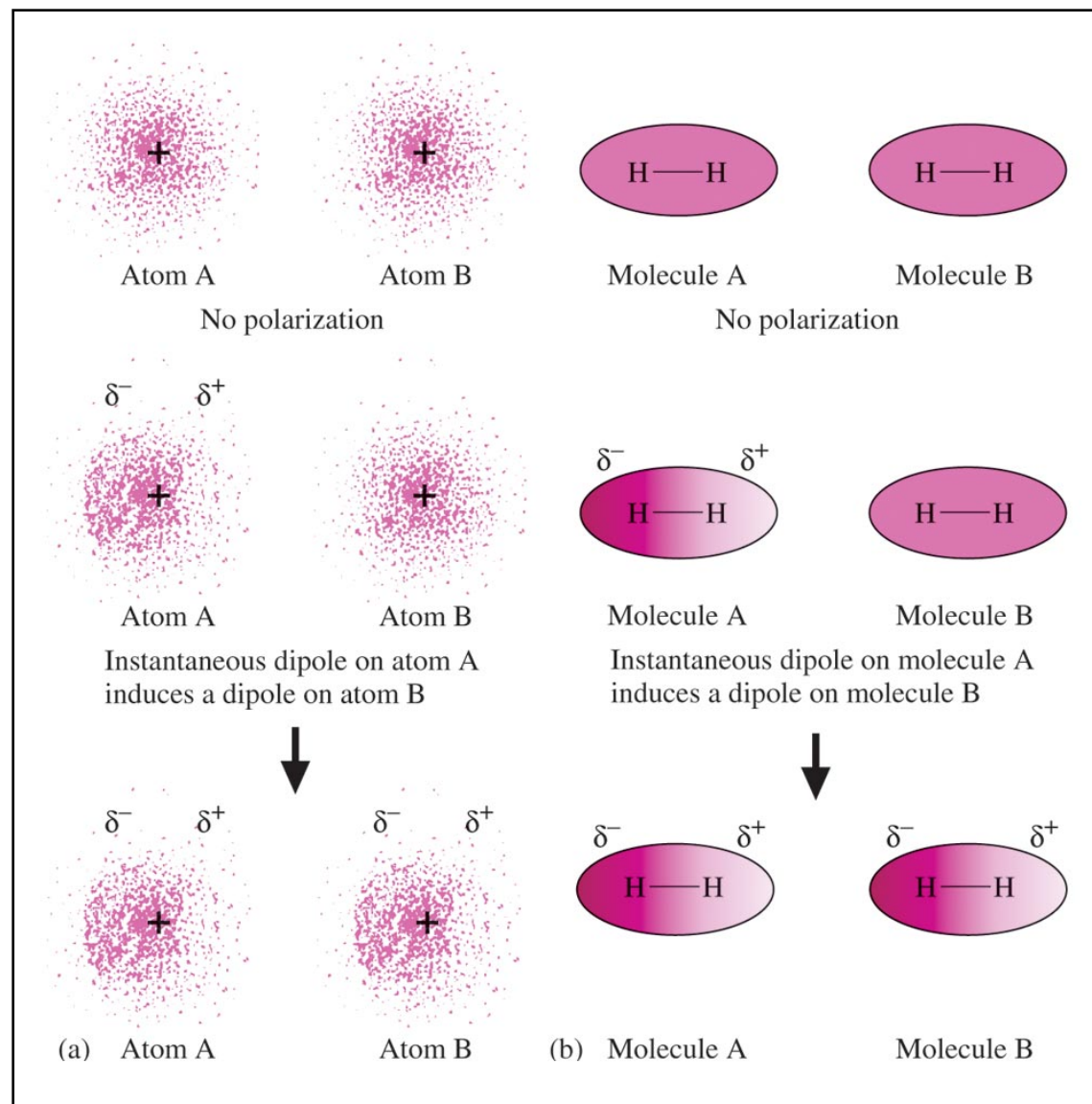


Figure 10.7
Nonpolar Liquid
Mercury Forms
a Convex
Meniscus in a
Glass Tube,
Whereas Polar
Water Forms a
Concave
Meniscus



Figure 10.6 A Molecule in the Interior of a Liquid is Attracted by the Molecules Surrounding It

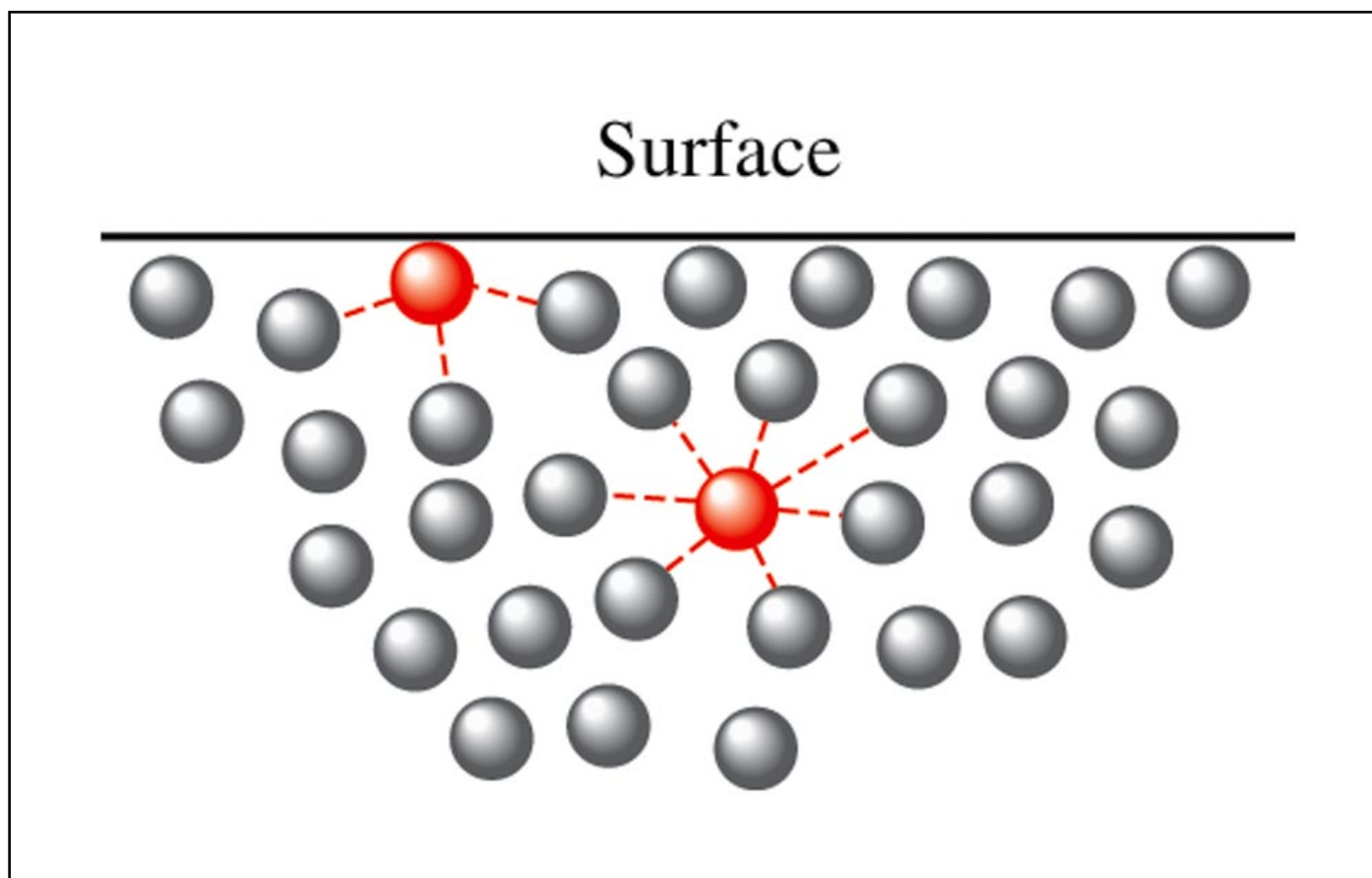


Table 10.2 The Freezing Points of the Group 8A Elements

TABLE 10.2 The Freezing Points of the Group 8A Elements

<u>Element</u>	<u>Freezing Point (°C)</u>
Helium*	−269.7
Neon	−248.6
Argon	−189.4
Krypton	−157.3
Xenon	−111.9

Figure 10.38 a-b Behavior of a Liquid in a Closed Container

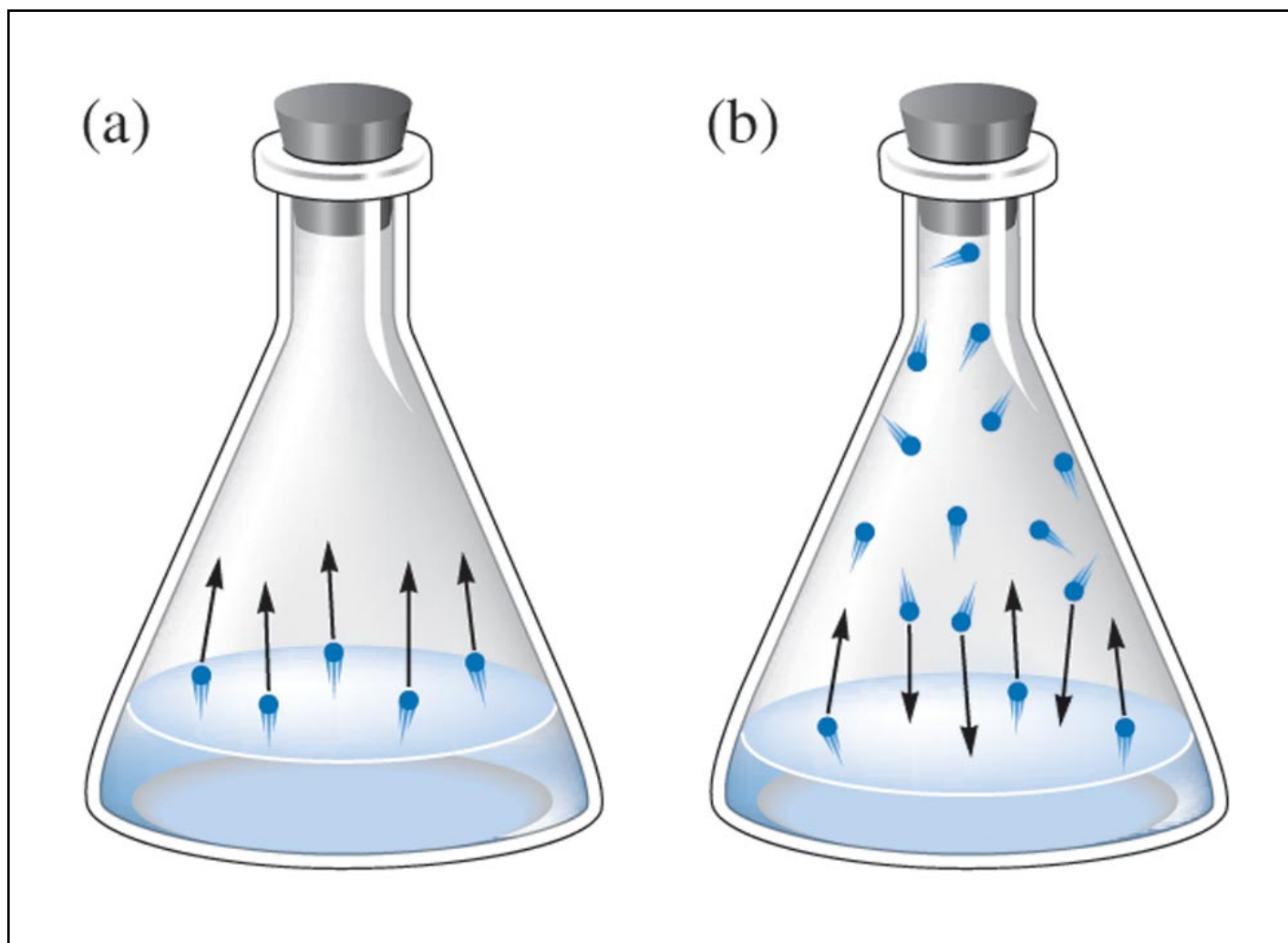


Figure 10.39 The Rates of Condensation and Evaporation Over Time for a Liquid Sealed in a Closed Container

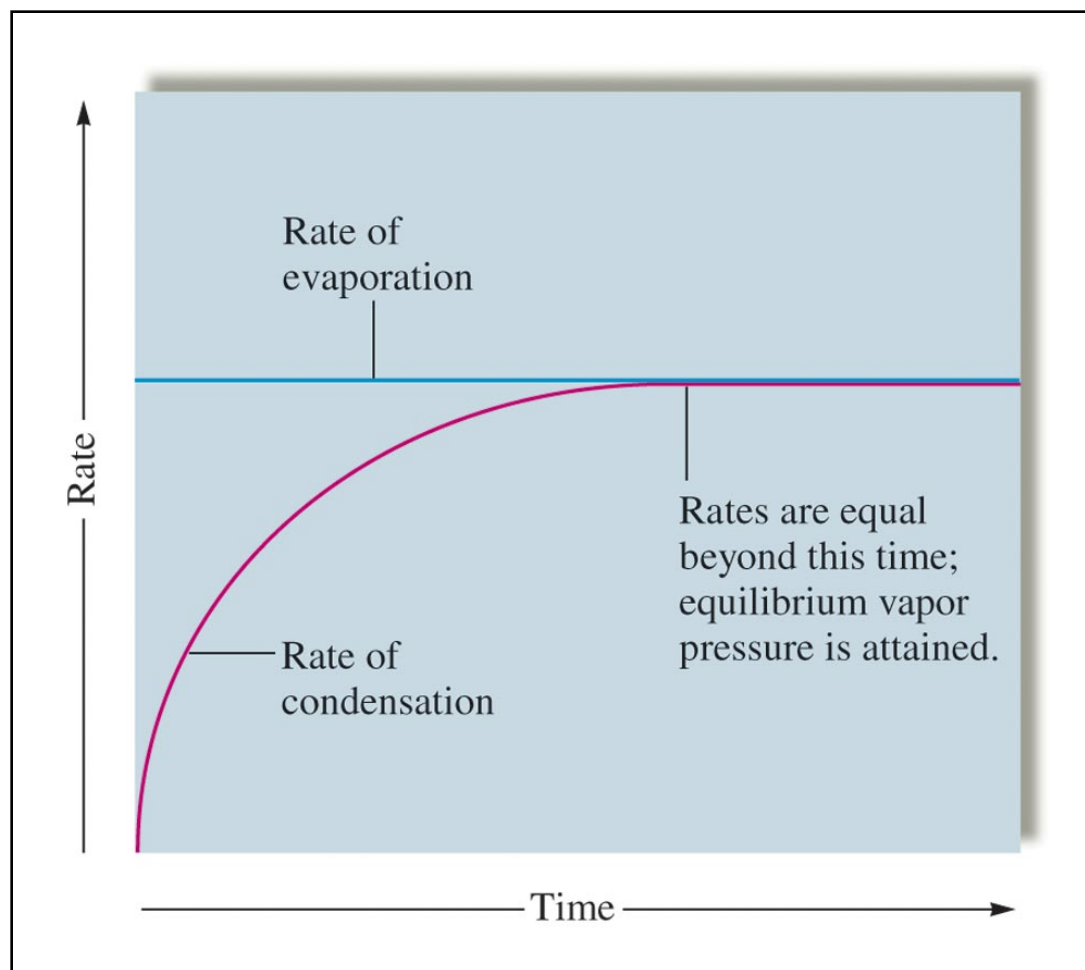


Figure 10.40 a-b Measuring the Vapor Pressure of a Liquid

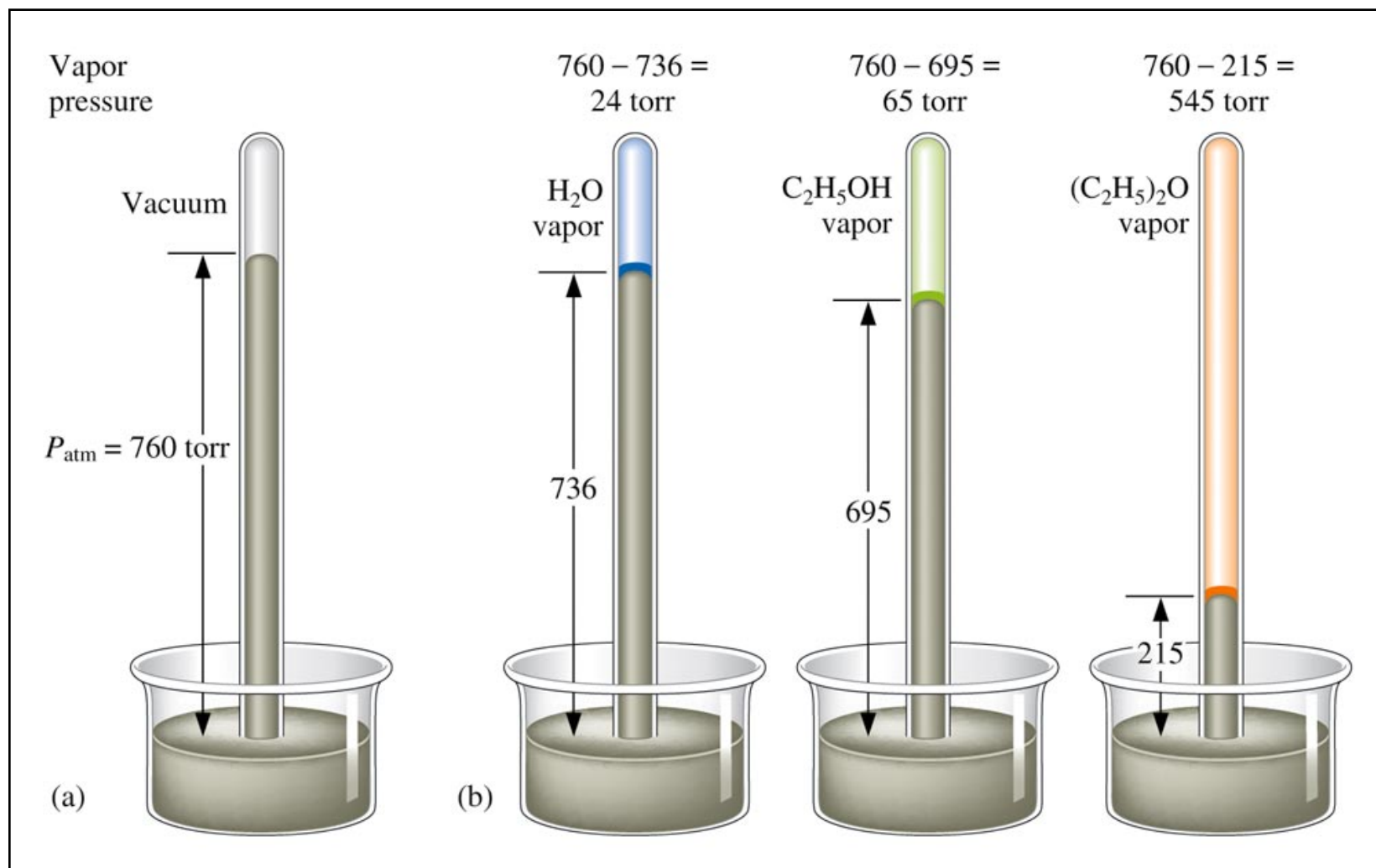


Figure 10.41 The Number of Molecules in a Liquid with a Given Energy versus Kinetic Energy at Two Temperatures

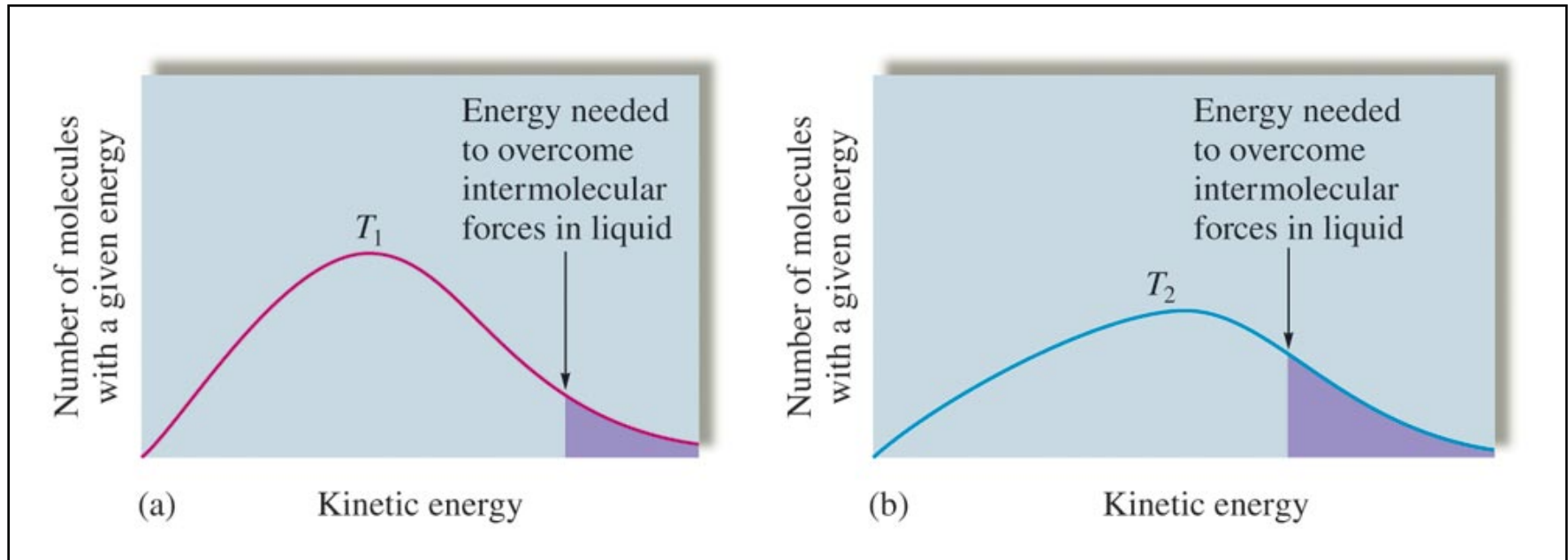


Table 10.8 The Vapor Pressure of Water as a Function of Temperature

TABLE 10.8 The Vapor Pressure of Water as a Function of Temperature

<i>T</i> (°C)	<i>P</i> (torr)
0.0	4.579
10.0	9.209
20.0	17.535
25.0	23.756
30.0	31.824
40.0	55.324
60.0	149.4
70.0	233.7
90.0	525.8

Figure 10.42 a & b The Vapor Pressure of Water, Ethanol, and Diethyl Ether as a Function of Temperature. (b) Plots of $\ln(P_{\text{vap}})$ versus $1/T$ for Water, Ethanol, and Diethyl Ether

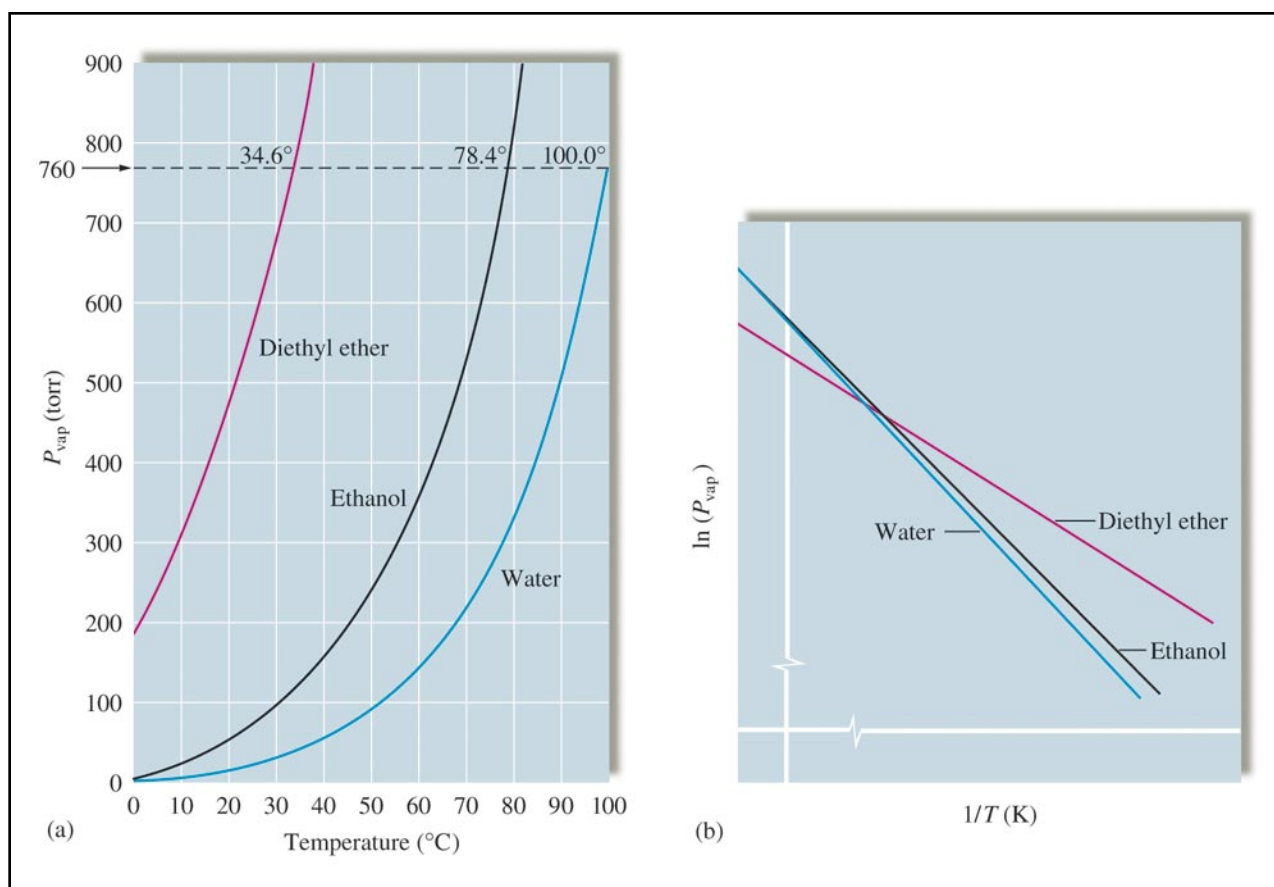
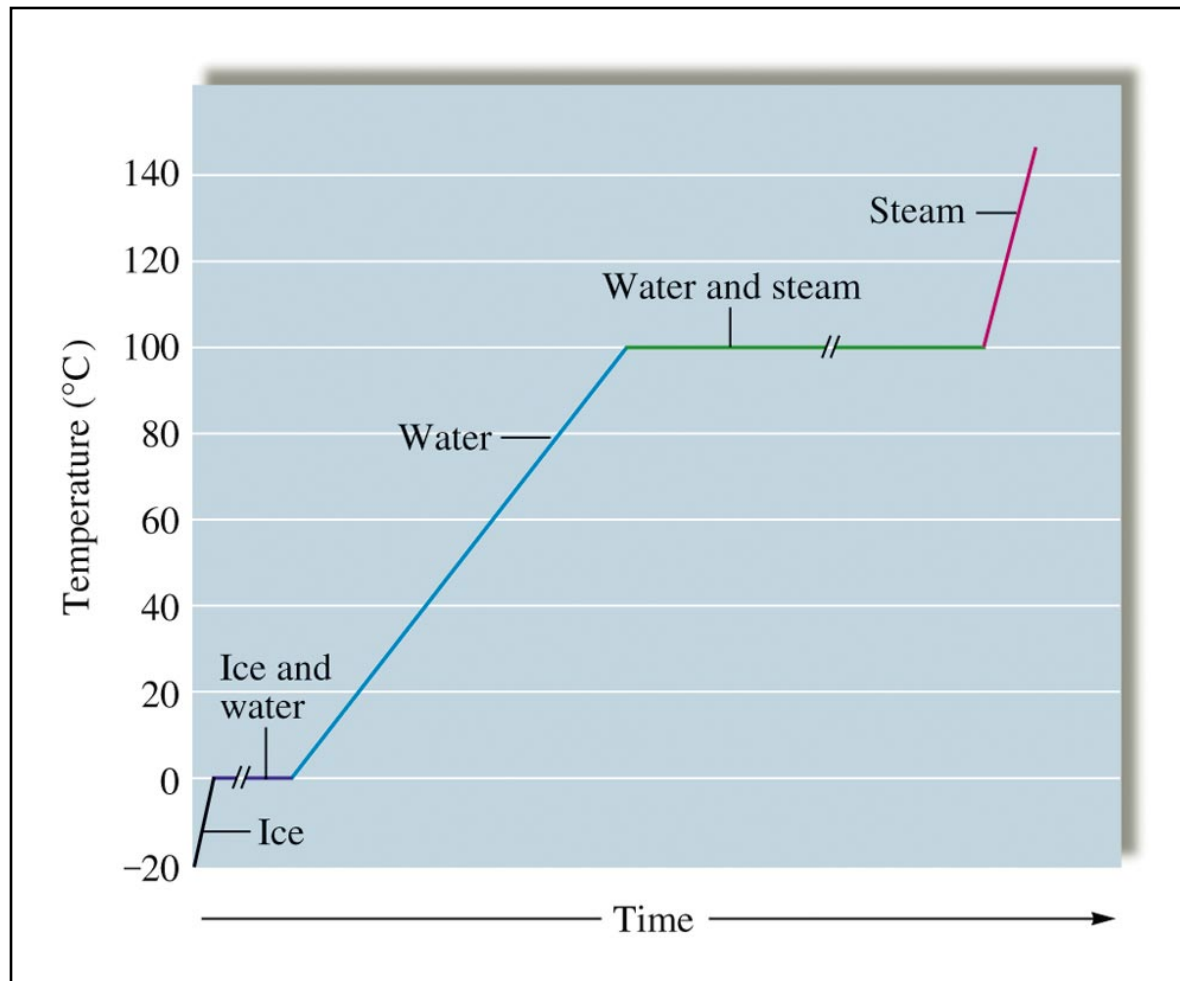
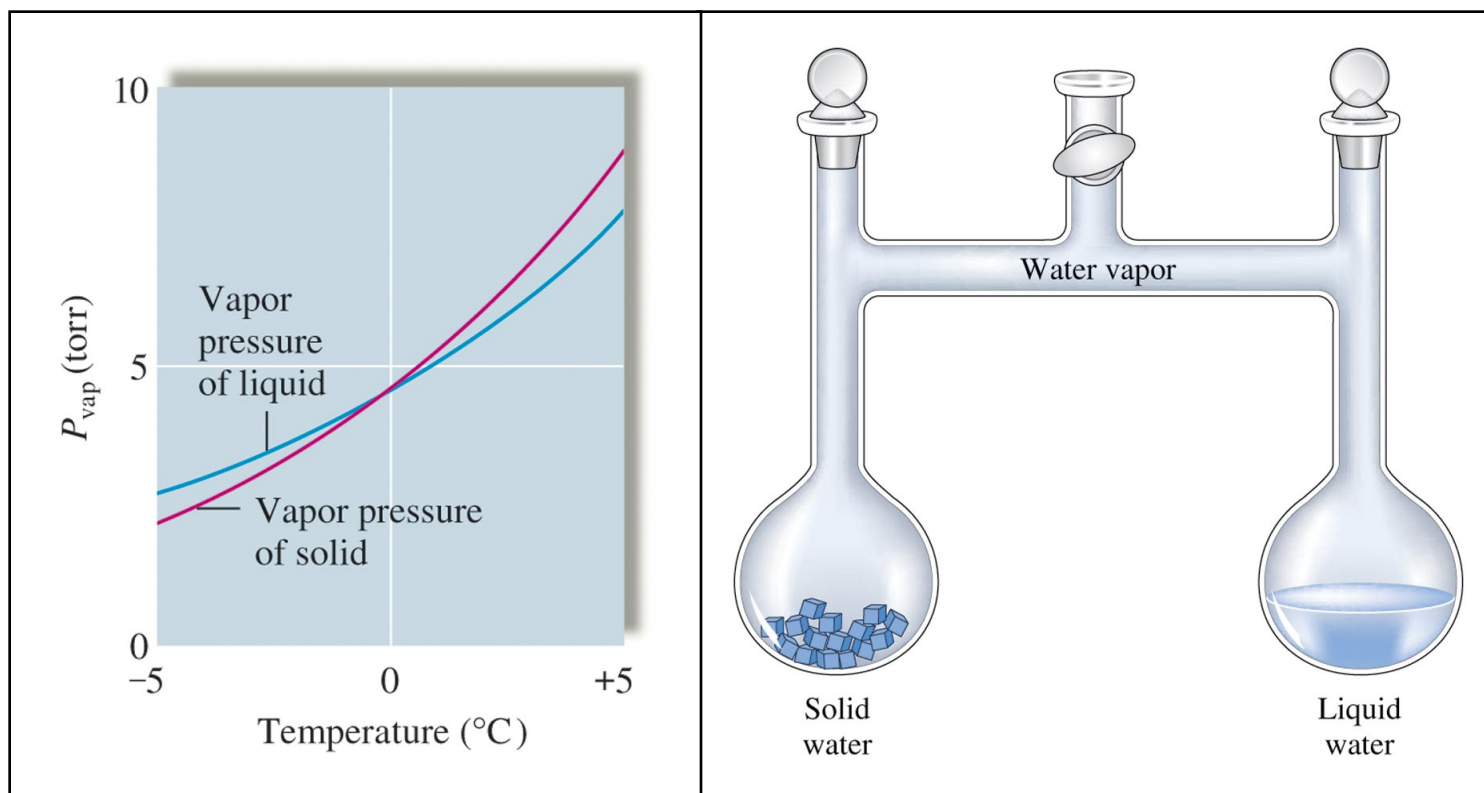


Figure 10.44 The Heating Curve (Not Drawn to Scale) for a Given Quantity of Water Where Energy is Added at a Constant Rate



Figures 10.45 and 10.46 Vapor Pressures of Solids Compared to Liquids



Case 1: High Temp

Case 2: Low Temp

Case 3: 0 $^{\circ}\text{C}$

Figure 10.48 The Supercooling of Water

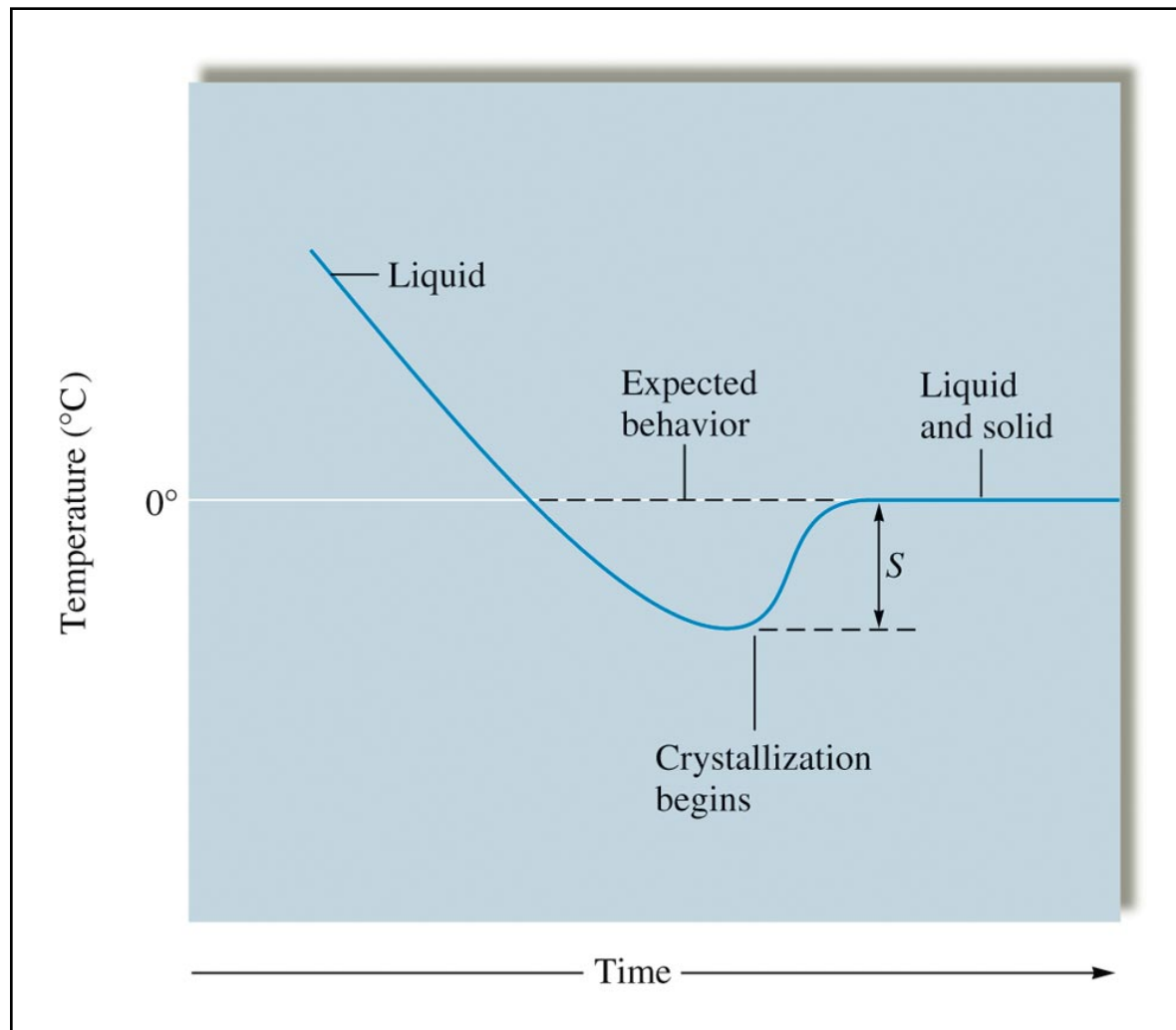


Table 10.10 Boiling Point of Water at Various Locations

TABLE 10.10 Boiling Point of Water at Various Locations

Location	Feet Above Sea Level	P_{atm} (torr)	Boiling Point (°C)
Top of Mt. Everest, Tibet	29,028	240	70
Top of Mt. McKinley, Alaska	20,320	340	79
Top of Mt. Whitney, Calif.	14,494	430	85
Leadville, Colo.	10,150	510	89
Top of Mt. Washington, N.H.	6,293	590	93
Boulder, Colo.	5,430	610	94
Madison, Wis.	900	730	99
New York City, N.Y.	10	760	100
Death Valley, Calif.	-282	770	100.3

Figure 10.49 The Phase Diagram for Water

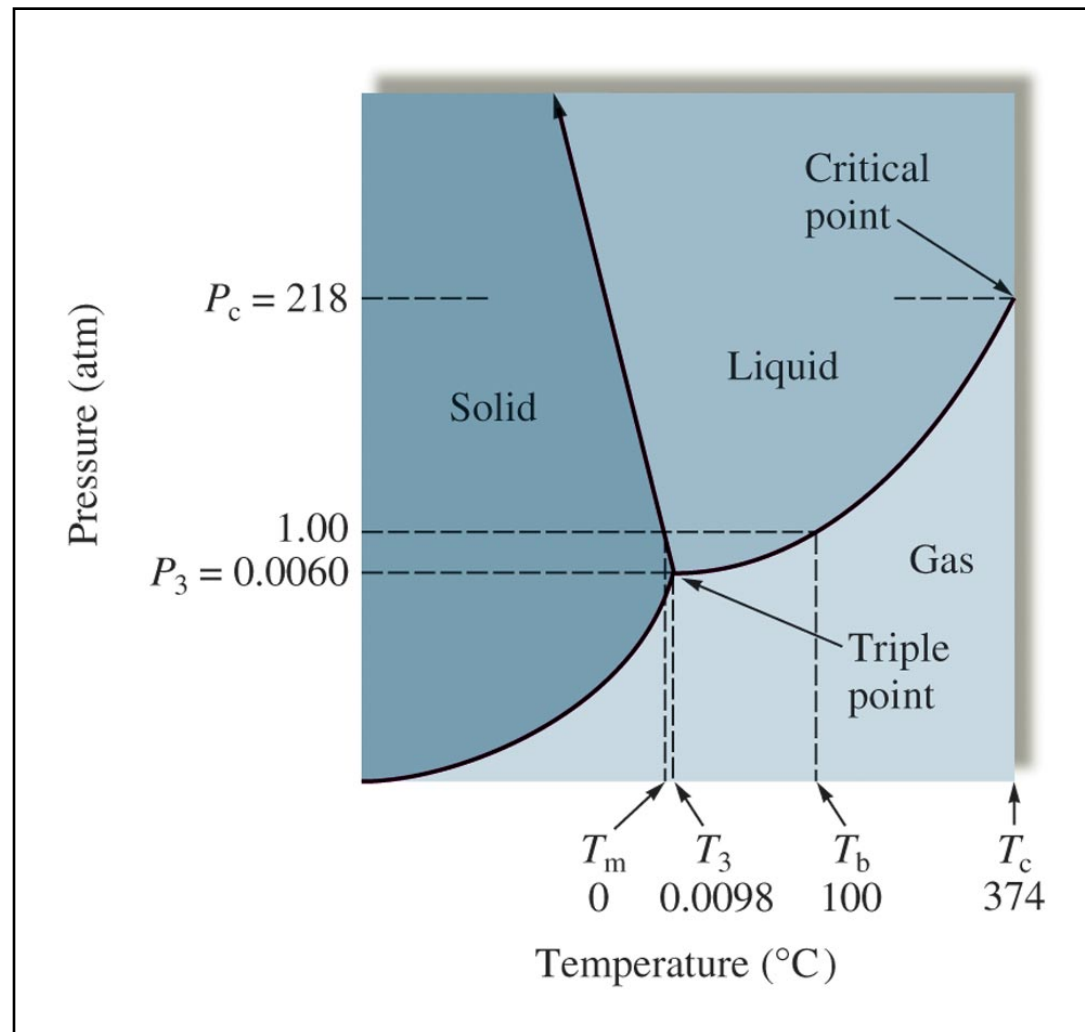


Figure 10.52 The Phase Diagram for Carbon Dioxide

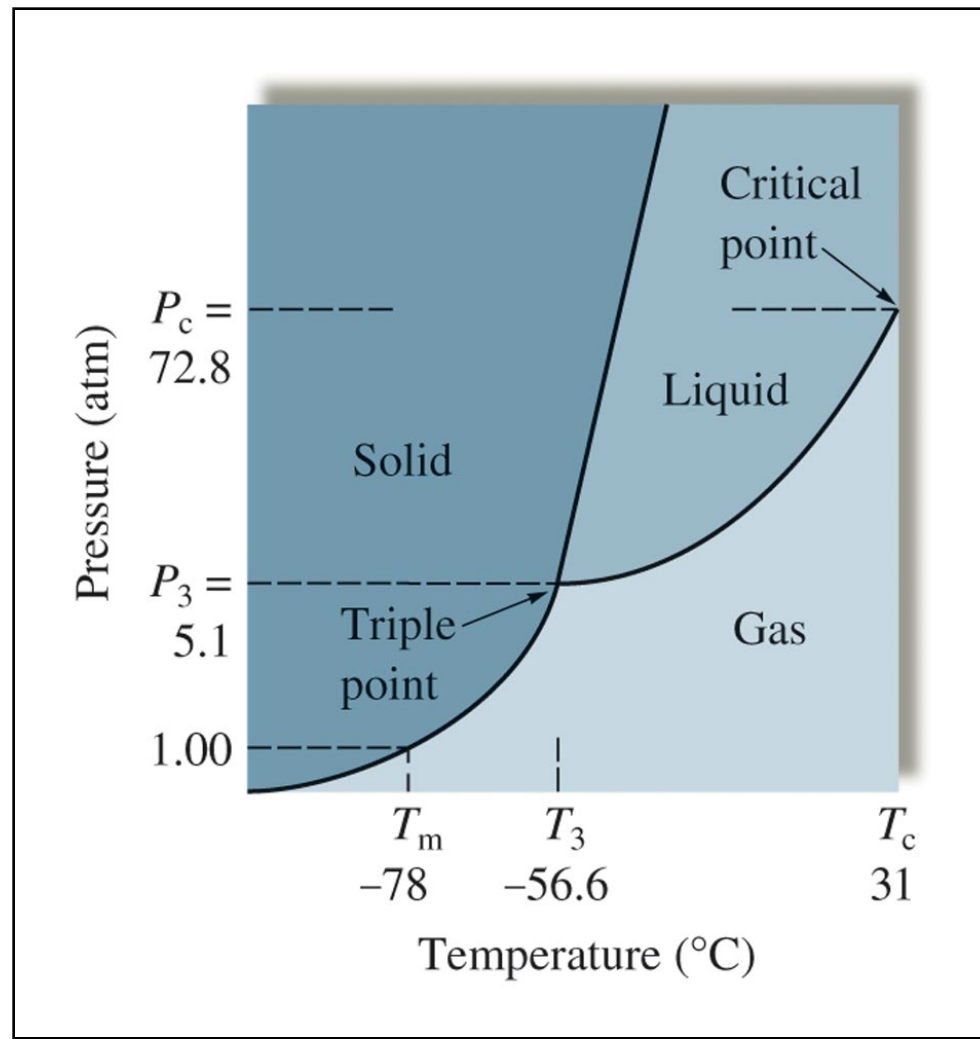


Table 11.1 Various Types of Solutions

TABLE 11.1 Various Types of Solutions

Example	State of Solution	State of Solute	State of Solvent
Air, natural gas	Gas	Gas	Gas
Vodka in water, antifreeze	Liquid	Liquid	Liquid
Brass	Solid	Solid	Solid
Carbonated water (soda)	Liquid	Gas	Liquid
Seawater, sugar solution	Liquid	Solid	Liquid
Hydrogen in platinum	Solid	Gas	Solid

Figure 11.1 The Formation of a Liquid Solution

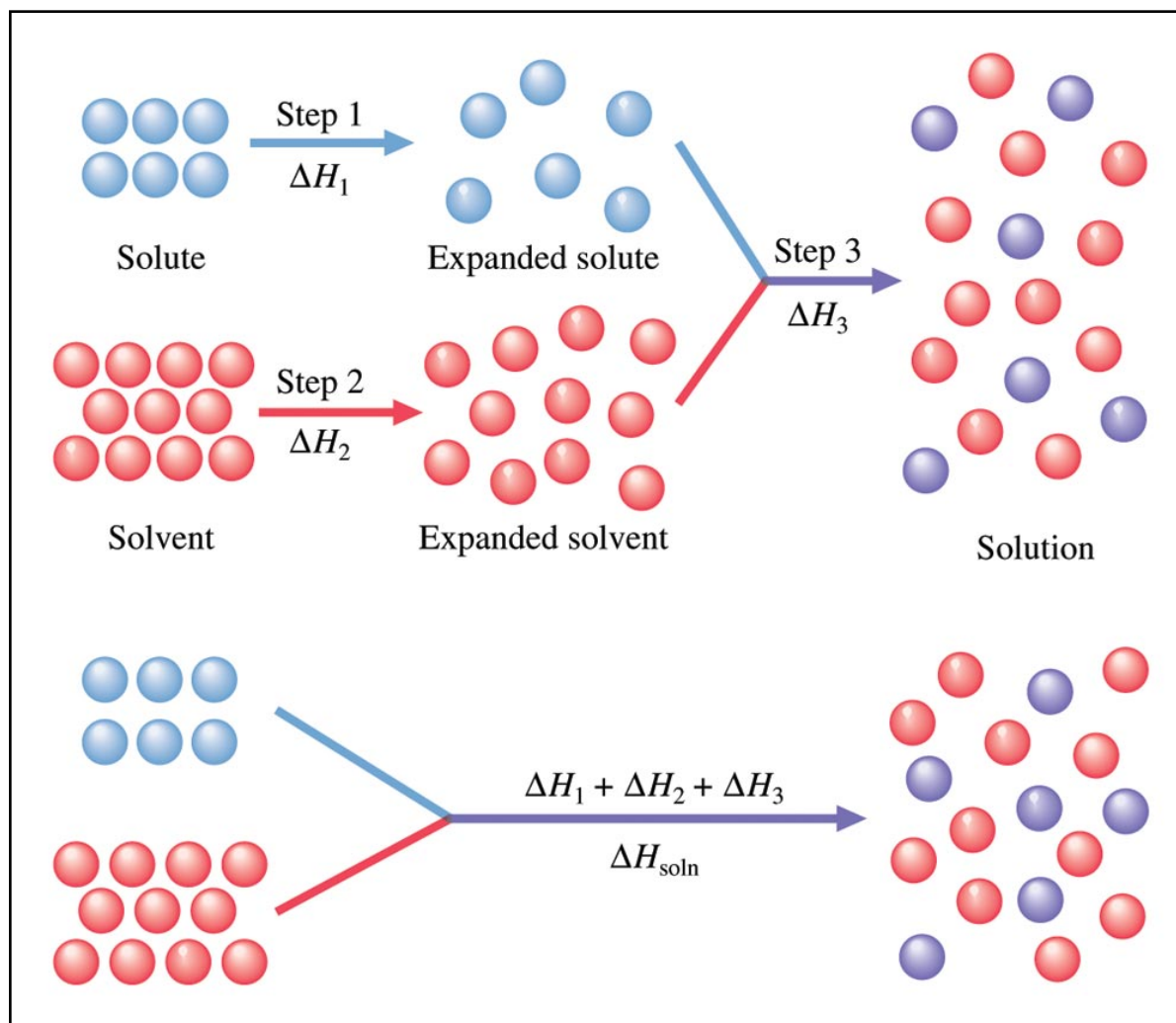


Figure 11.2 a&b (a) Exothermic and (b) Endothermic

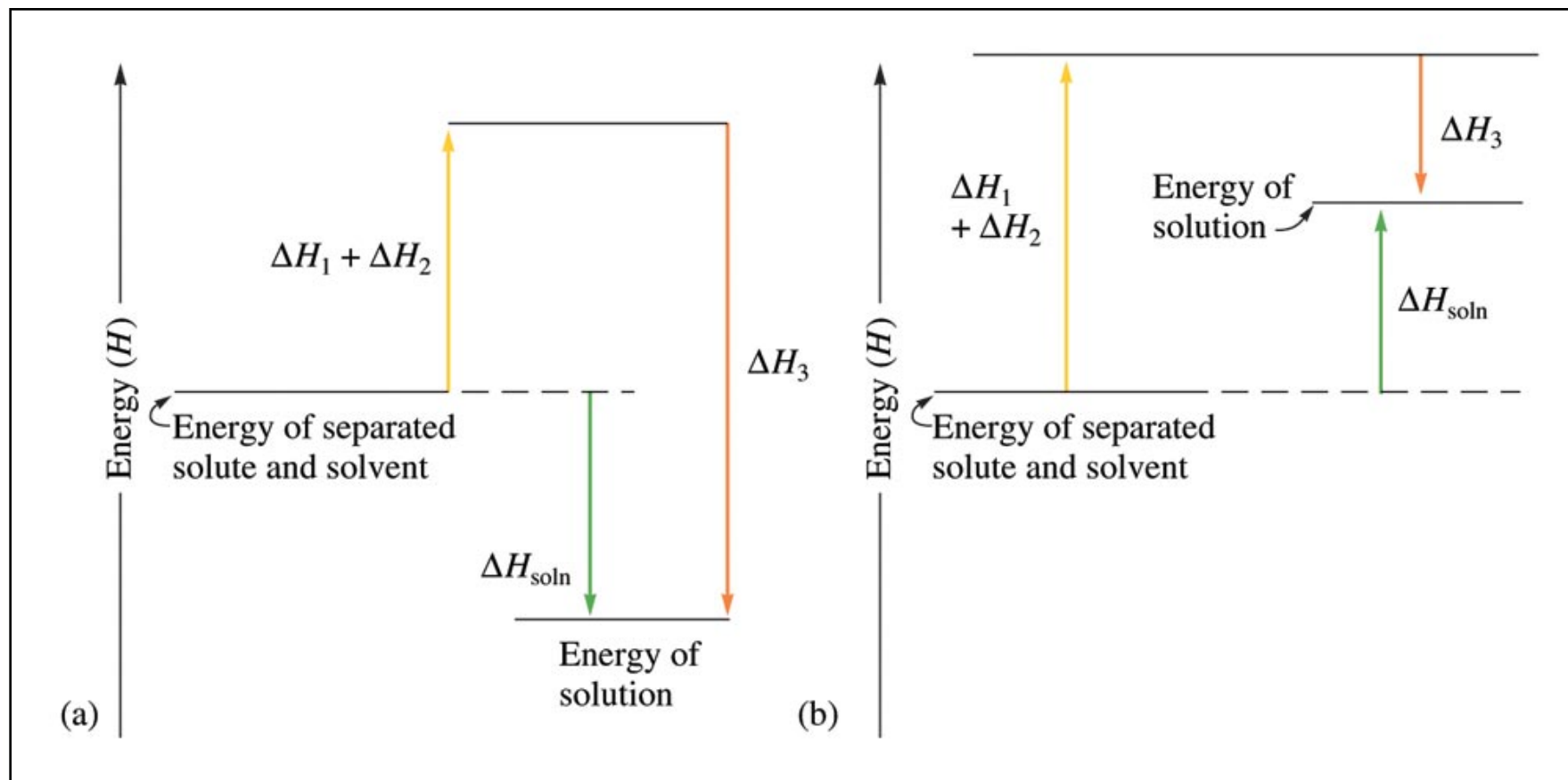


Table 11.3 The Energy Terms for Various Types of Solutes and Solvents

TABLE 11.3 The Energy Terms for Various Types of Solutes and Solvents

	ΔH_1	ΔH_2	ΔH_3	ΔH_{soln}	Outcome
Polar solute, polar solvent	Large	Large	Large, negative	Small	Solution forms
Nonpolar solute, polar solvent	Small	Large	Small	Large, positive	No solution forms
Nonpolar solute, nonpolar solvent	Small	Small	Small	Small	Solution forms
Polar solute, nonpolar solvent	Large	Small	Small	Large, positive	No solution forms

Figure 11.4 The Molecular Structures of (a) Vitamin A and (b) Vitamin C

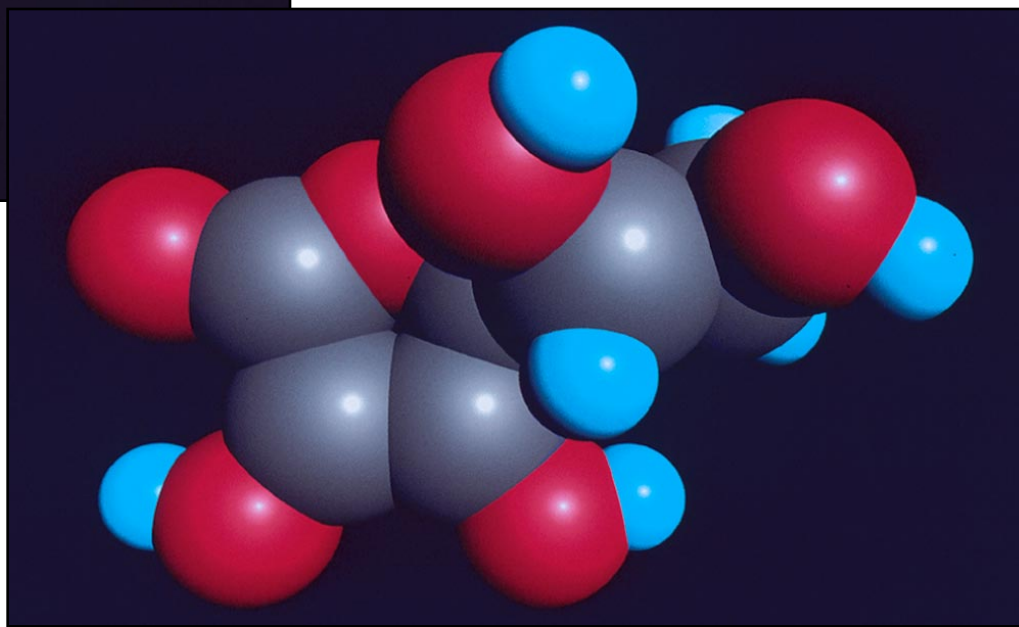
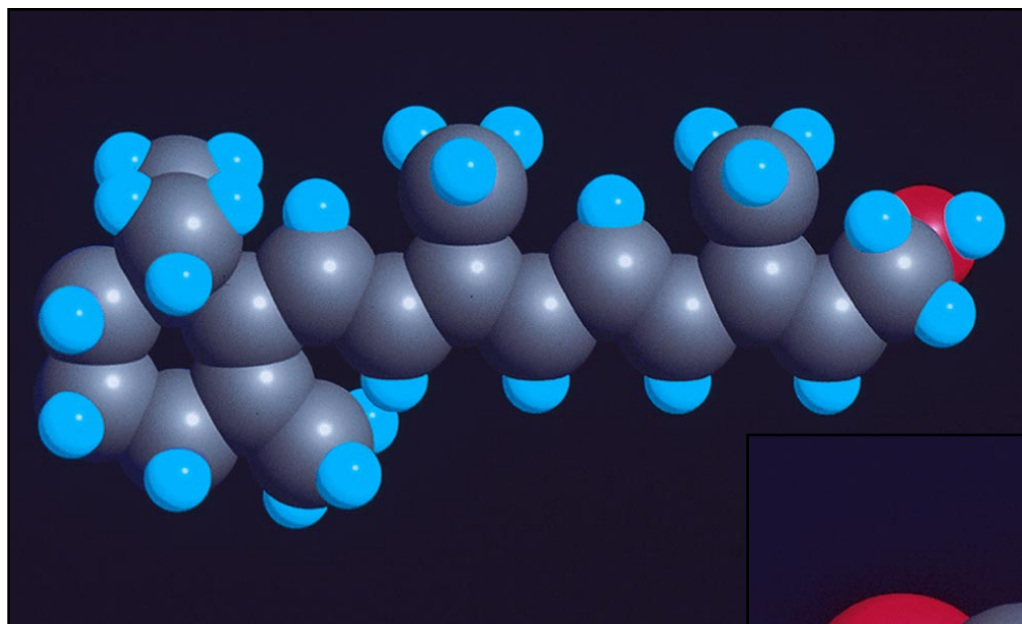


Figure 11.5 a-c Henry's Law

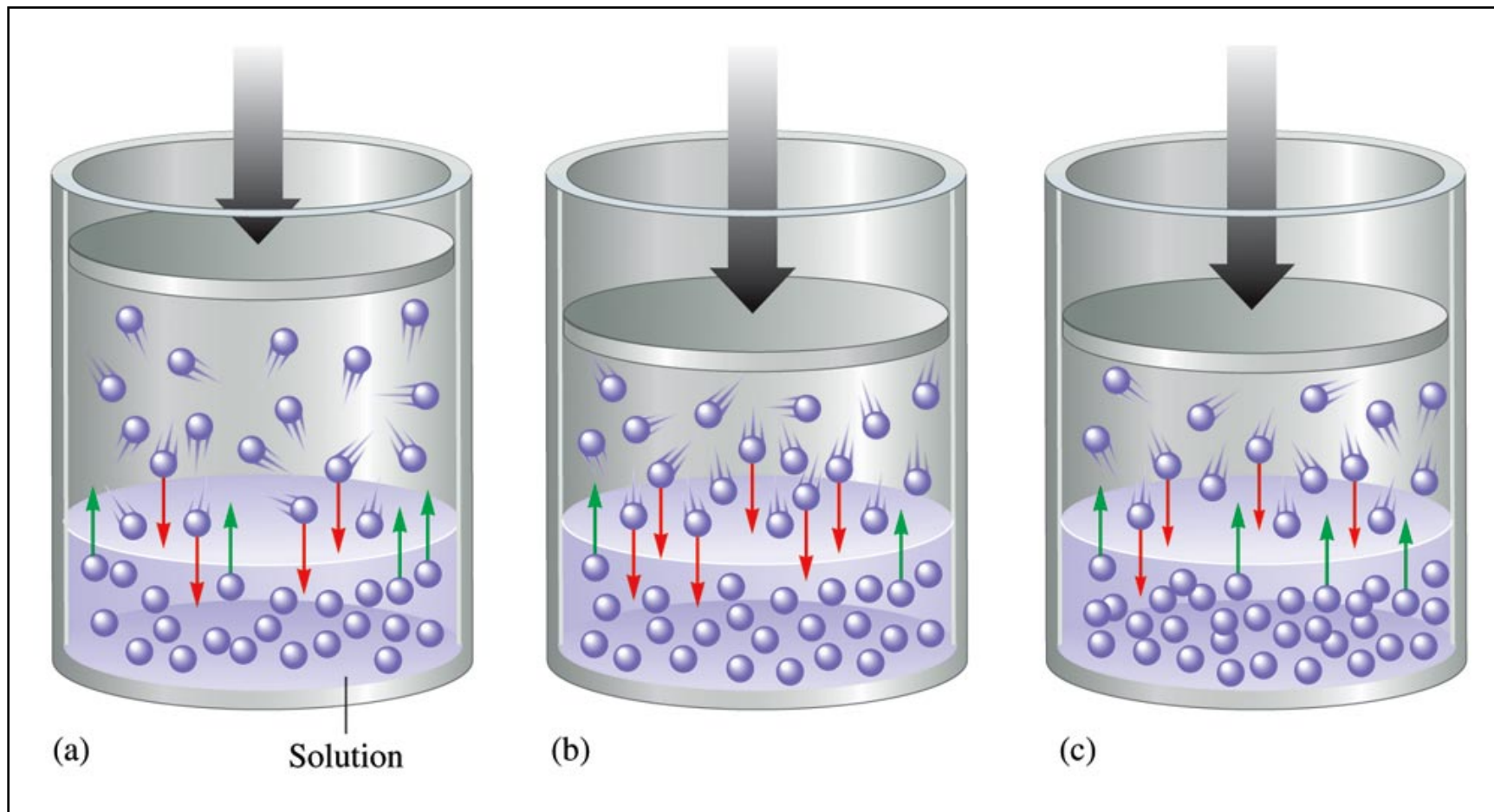


Figure 11.6
The
Solubilities
of Several
Solids as a
Function of
Temperature

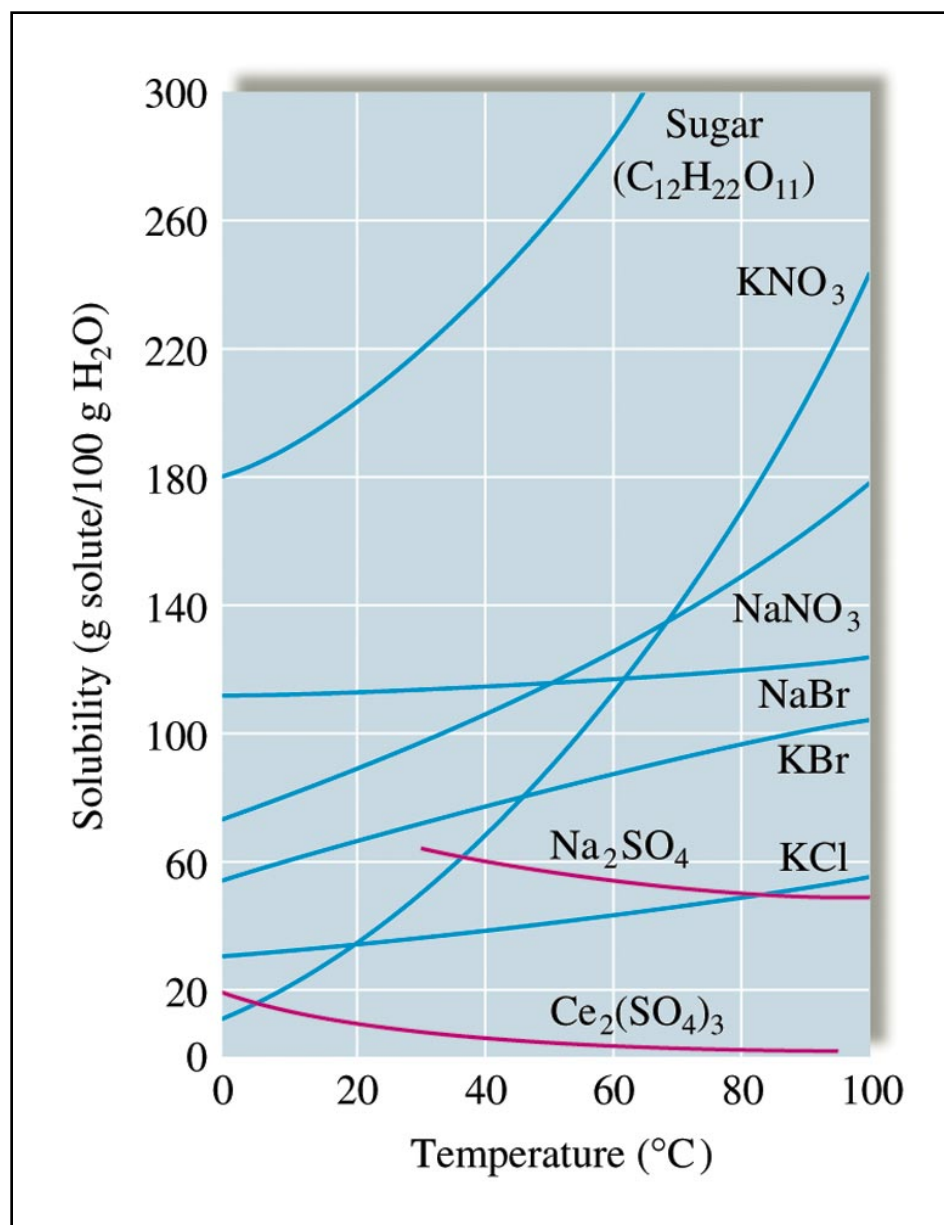


Figure 11.7

The Solubilities of Several Gases in Water as a Function of Temperature

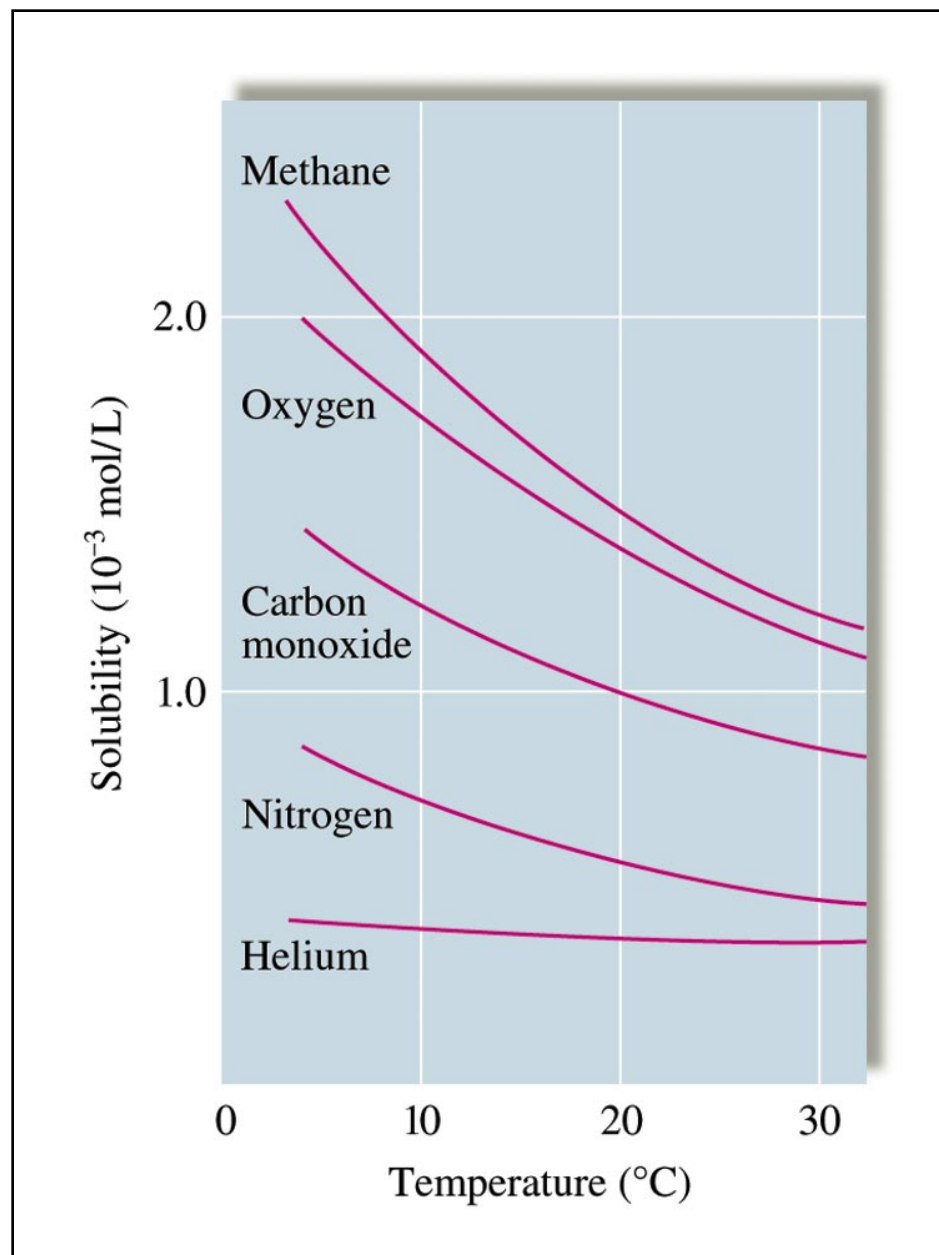


Figure 11.9 An Aqueous Solution and Pure Water in a Closed Environment

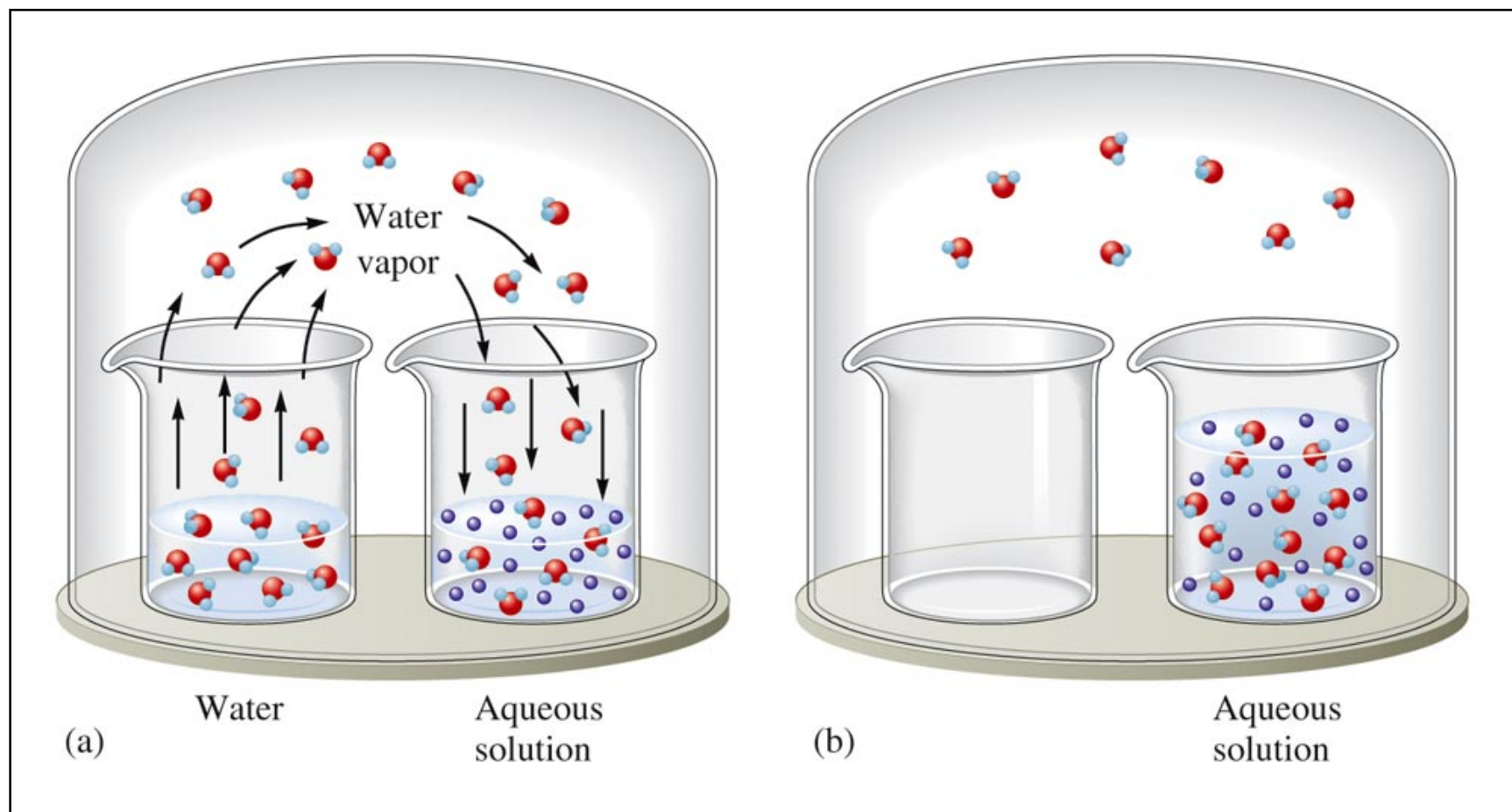


Figure 11.10 The Presence of a Nonvolatile Solute Lowers the Vapor Pressure of the Solvent

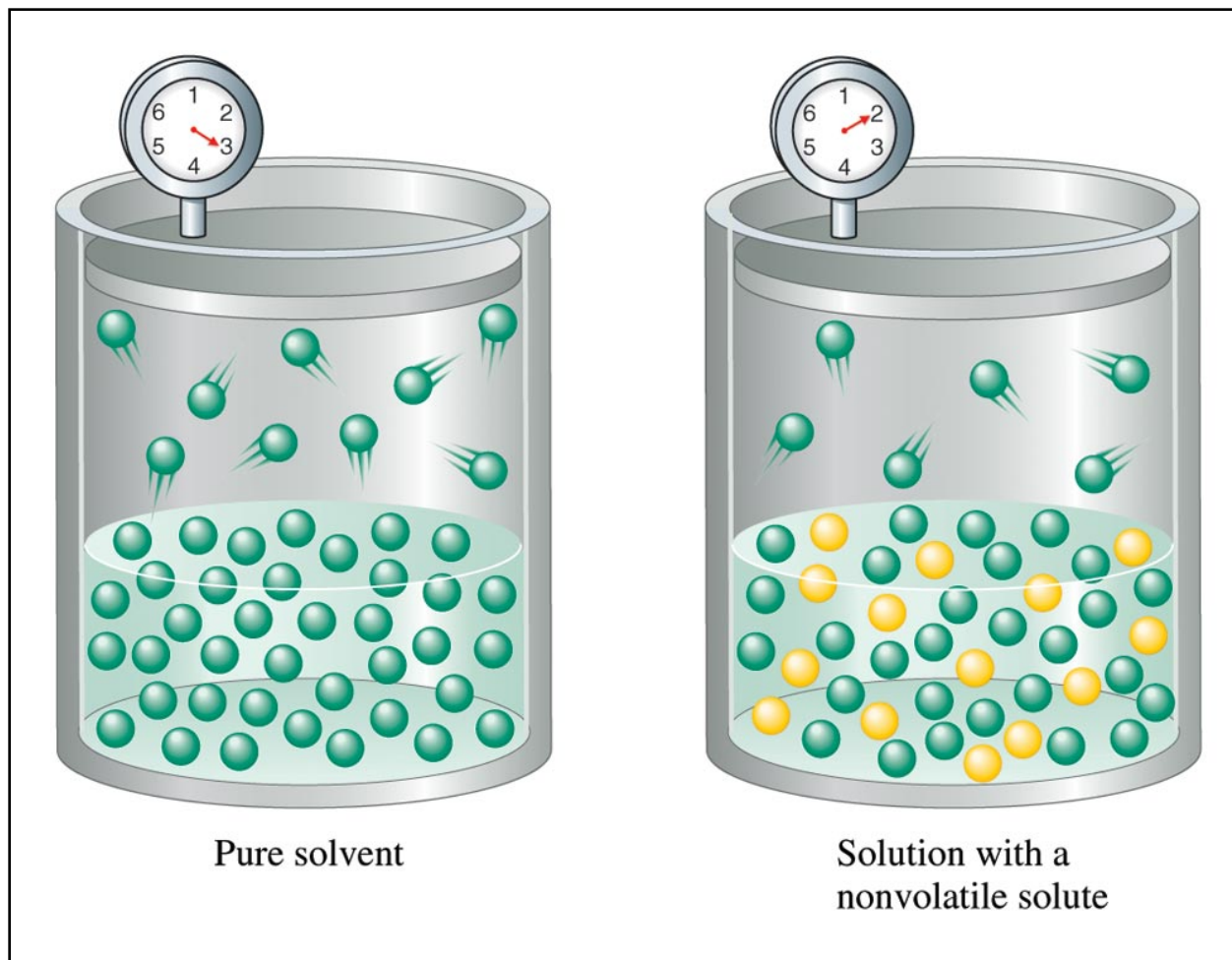


Figure 11.11
For a Solution
that Obeys
Raoult's Law,
a Plot fo P_{soln}
Versus X_{solvent} ,
Give a
Straight Line

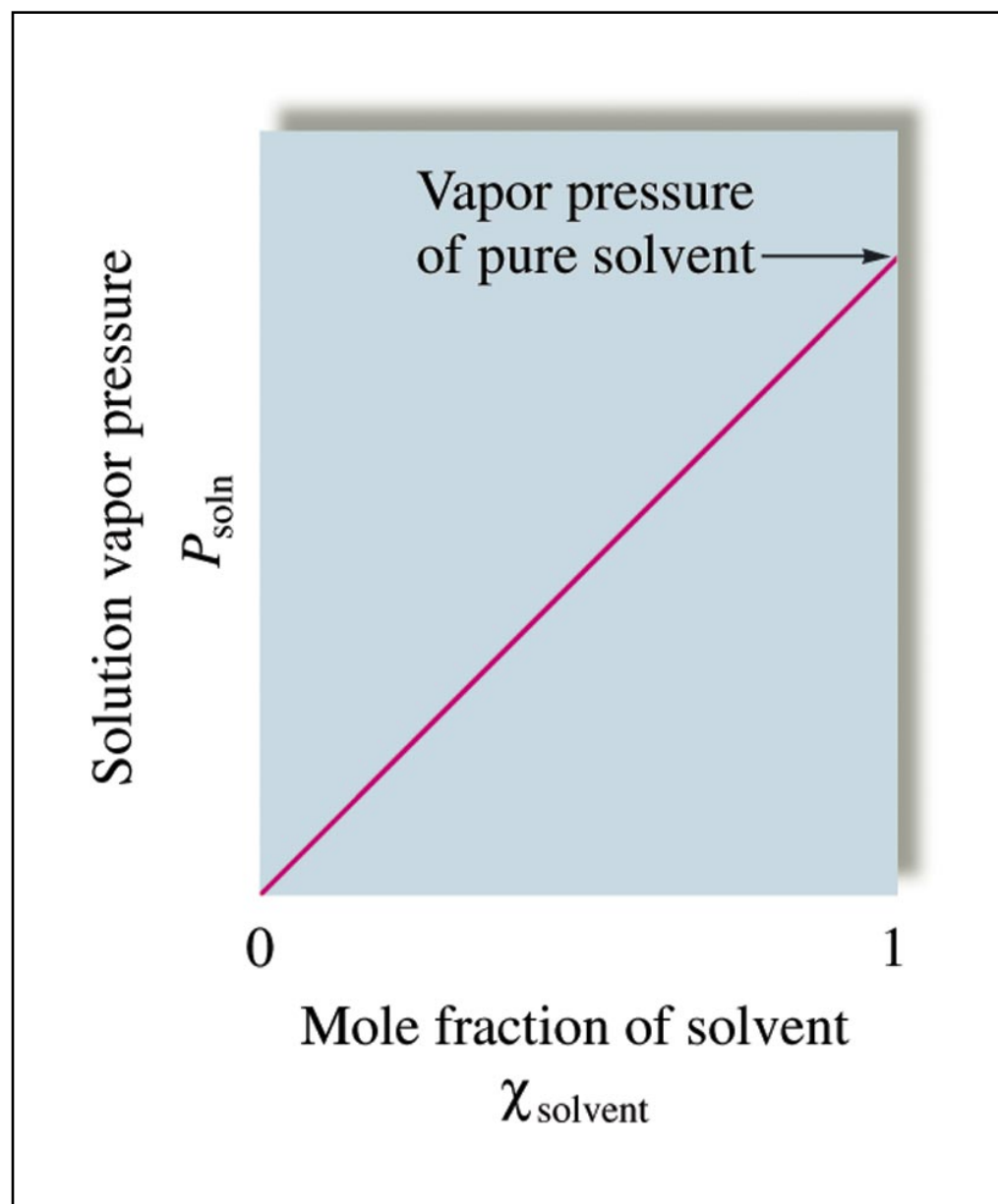


Figure 11.14 Phase Diagrams for Pure Water (Red) and for an Aqueous Solution Containing a Nonvolatile Solute (Blues)

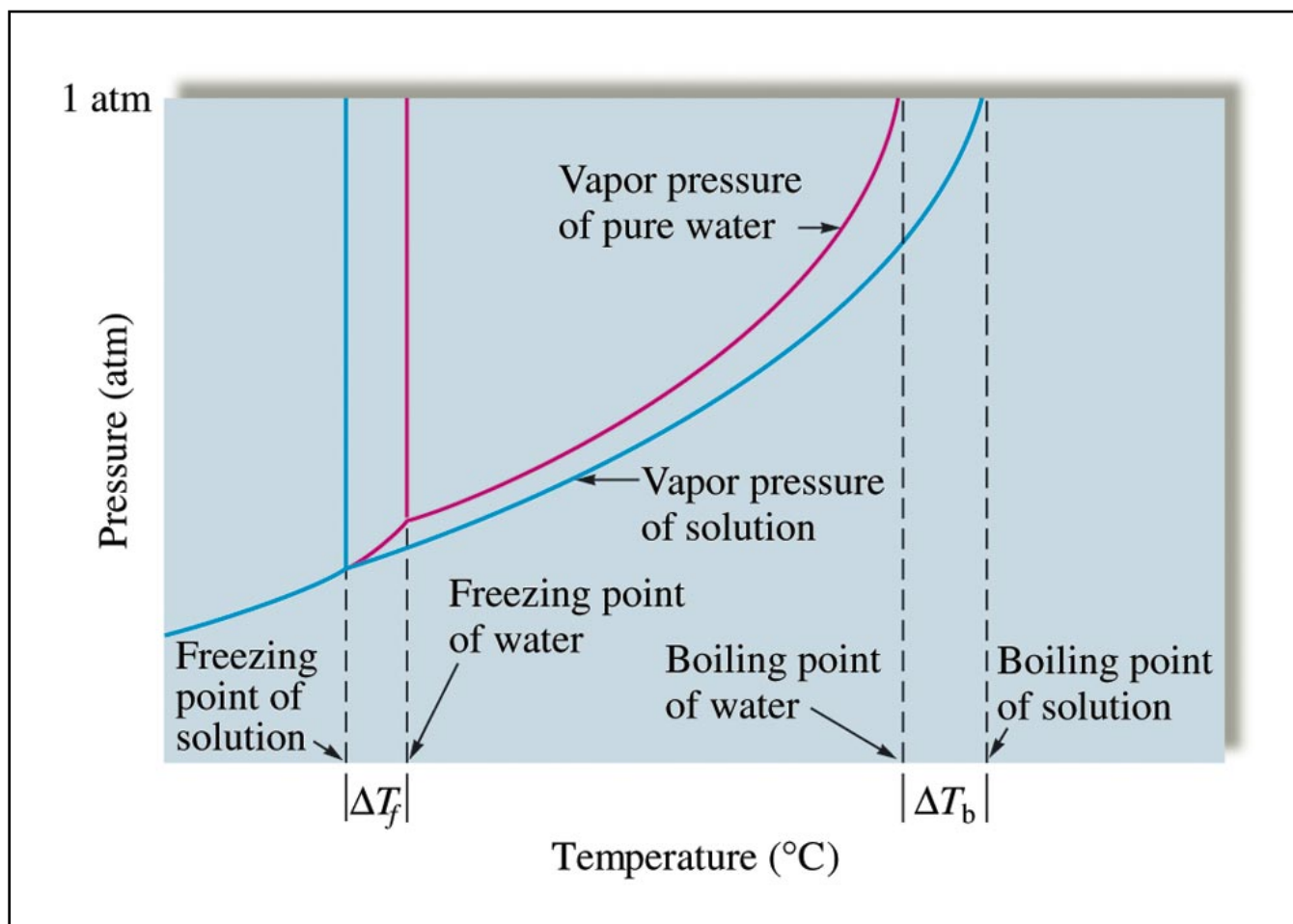


Figure 10.45
The Vapor
Pressures of
Solid and
Liquid Water
as a
Function of
Temperature

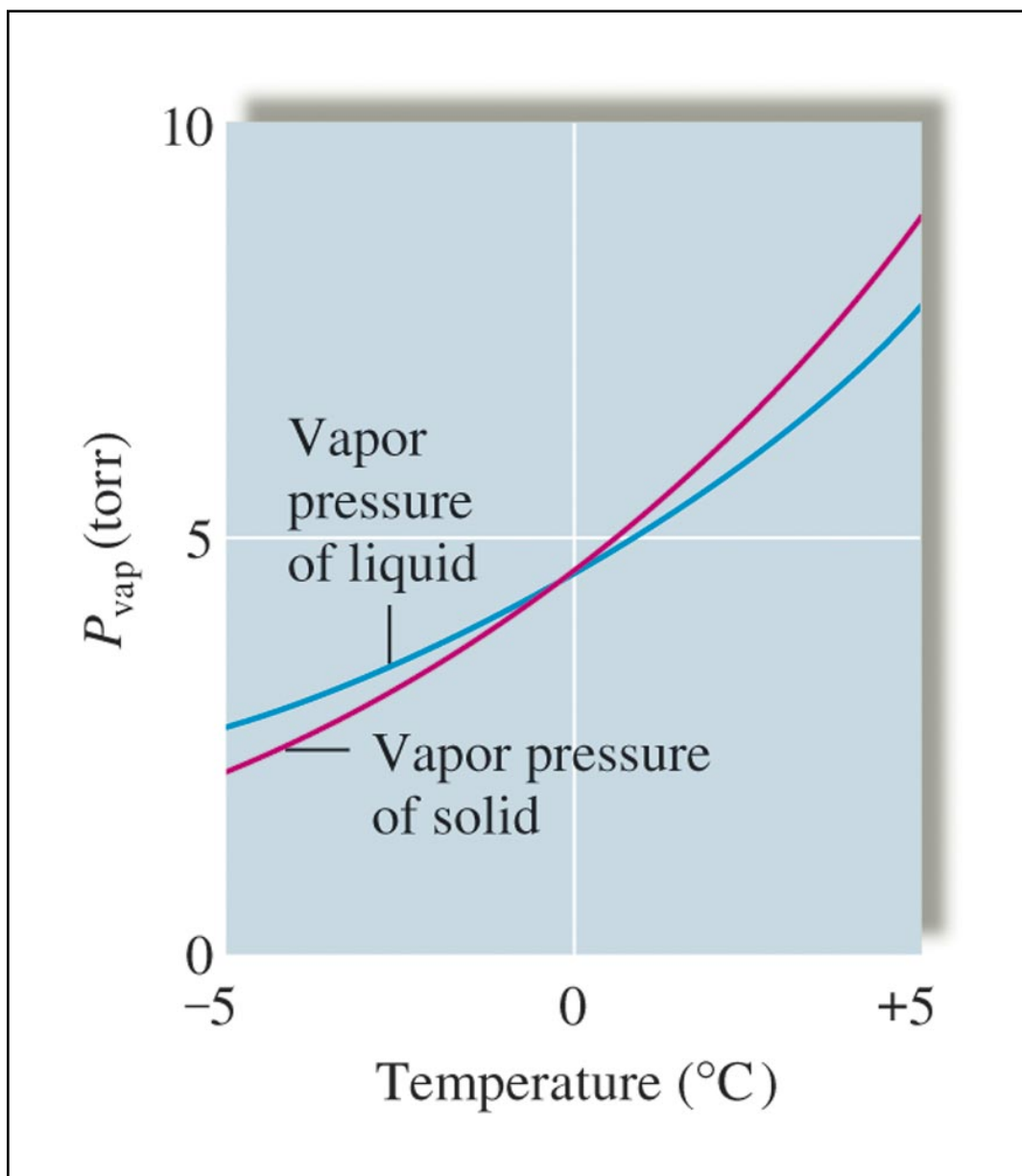


Table 11.5 Molal Boiling-Point Elevation Constants (K_b) and Freezing-Point Depression Constants (K_f) for Several Solvents

TABLE 11.5 Molal Boiling-Point Elevation Constants (K_b) and Freezing-Point Depression Constants (K_f) for Several Solvents

Solvent	Boiling Point (°C)	K_b (°C · kg/mol)	Freezing Point (°C)	K_f (°C · kg/mol)
Water (H ₂ O)	100.0	0.51	0	1.86
Carbon tetrachloride (CCl ₄)	76.5	5.03	−22.99	30.
Chloroform (CHCl ₃)	61.2	3.63	−63.5	4.70
Benzene (C ₆ H ₆)	80.1	2.53	5.5	5.12
Carbon disulfide (CS ₂)	46.2	2.34	−111.5	3.83
Ethyl ether (C ₄ H ₁₀ O)	34.5	2.02	−116.2	1.79
Camphor (C ₁₀ H ₁₆ O)	208.0	5.95	179.8	40.

Table 11.6 Expected and Observed Values of the van't Hoff Factor for 0.05 m Solutions of Several Electrolytes

TABLE 11.6 Expected and Observed Values of the van't Hoff Factor for 0.05 *m* Solutions of Several Electrolytes

Electrolyte	<i>i</i> (expected)	<i>i</i> (observed)
NaCl	2.0	1.9
MgCl ₂	3.0	2.7
MgSO ₄	2.0	1.3
FeCl ₃	4.0	3.4
HCl	2.0	1.9
Glucose*	1.0	1.0

*A nonelectrolyte shown for comparison.

Figure 11.16 A Tube with a Bulb on the End that is Covered by a Semipermeable Membrane

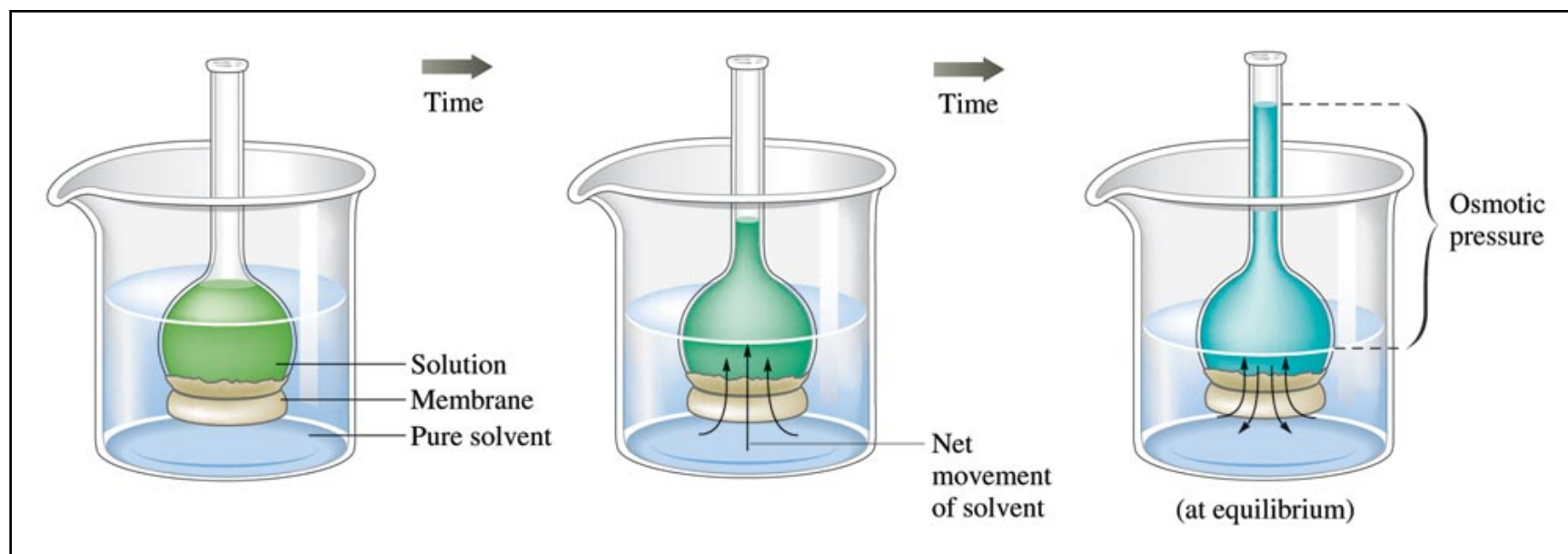


Figure 11.17 Osmosis can be Prevented by Applying Pressure to the Solution

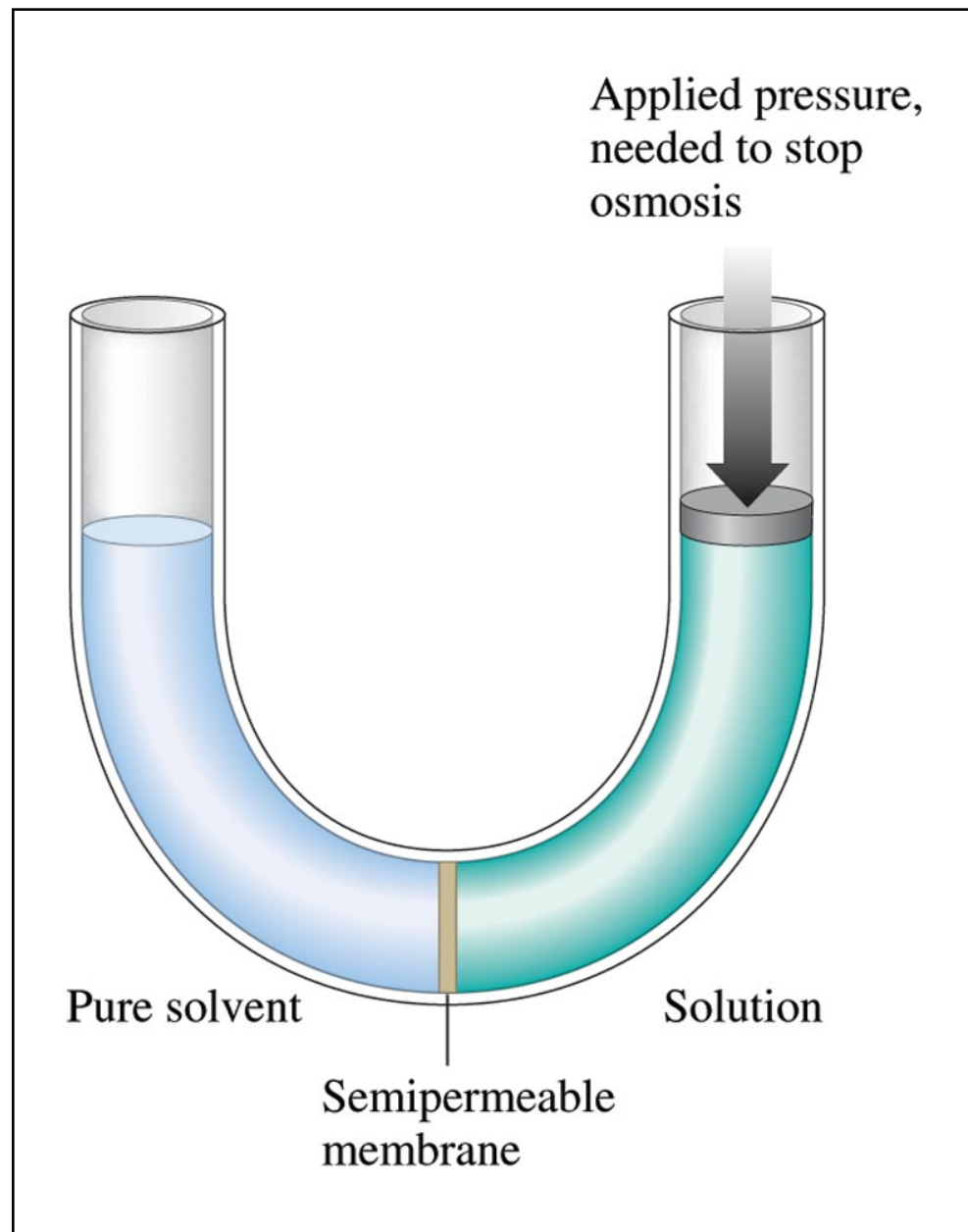


Figure 11.18 Osmotic Pressure

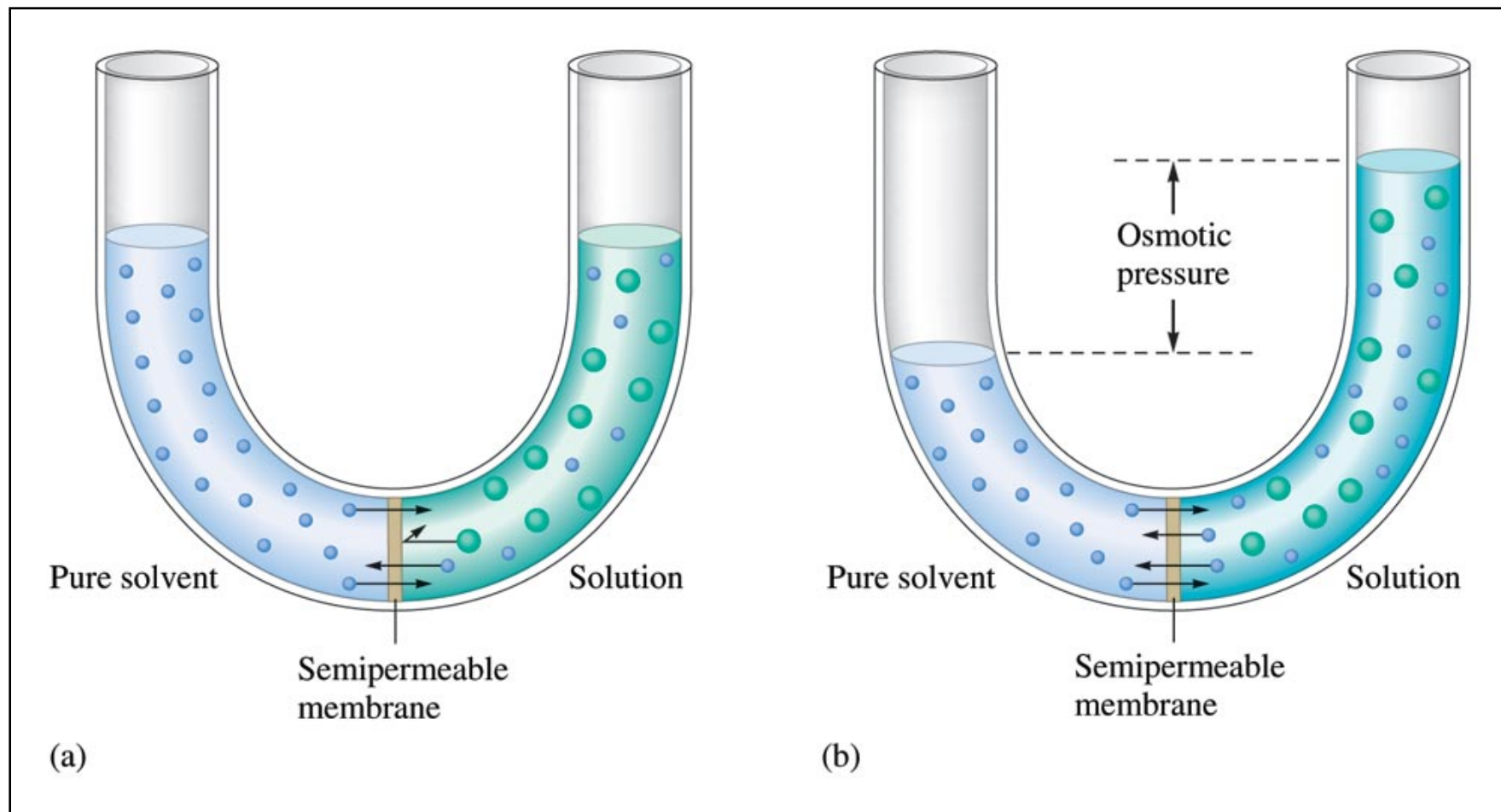


Figure 11.19 Functioning of the Artificial Kidney

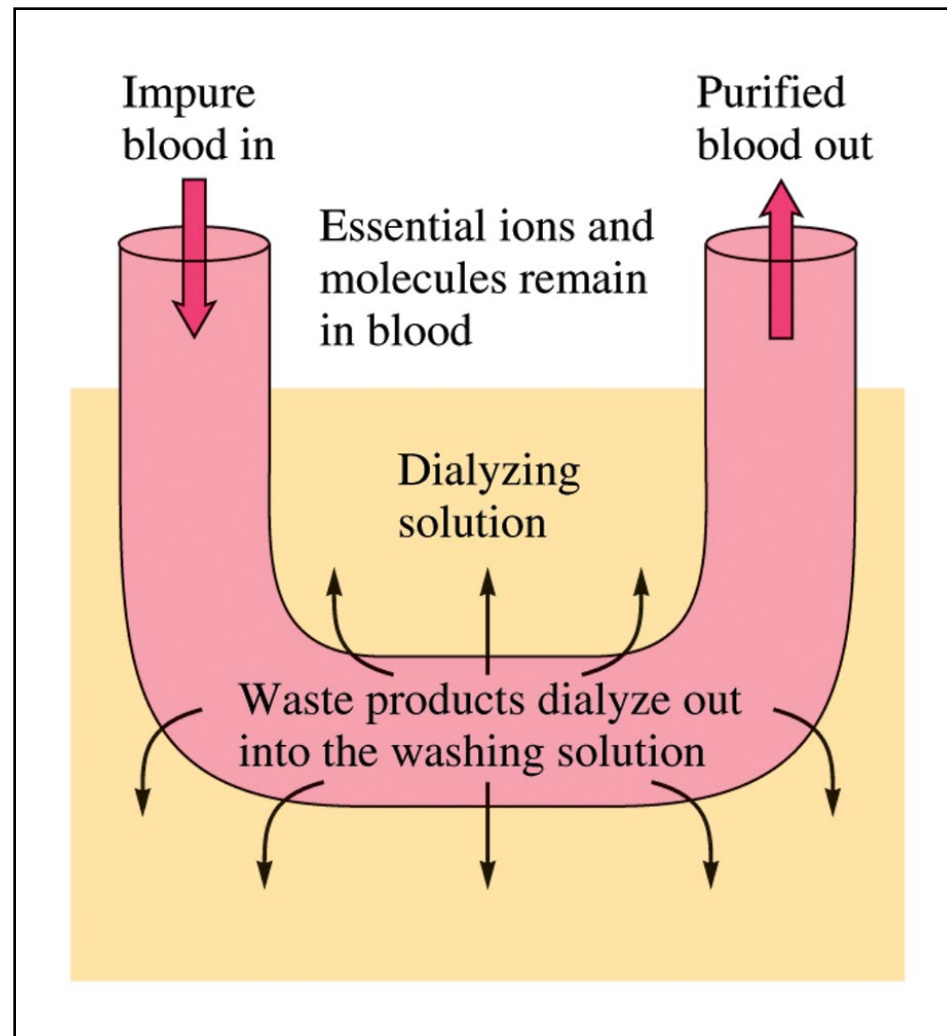


Figure 11.20
Reverse
Osmosis

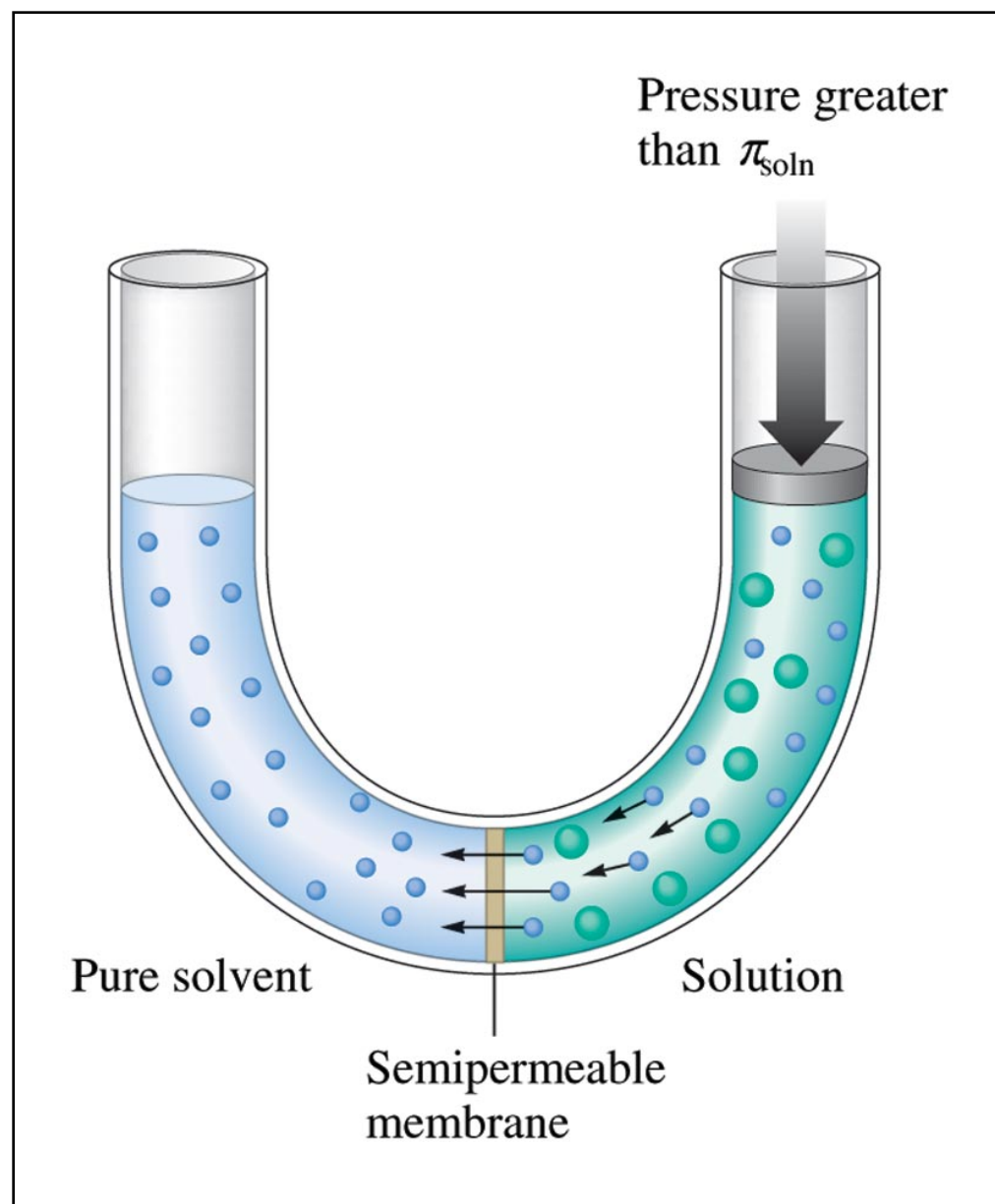


Figure 11.21 (b) Machinery in the desalination plant for Catalina Island

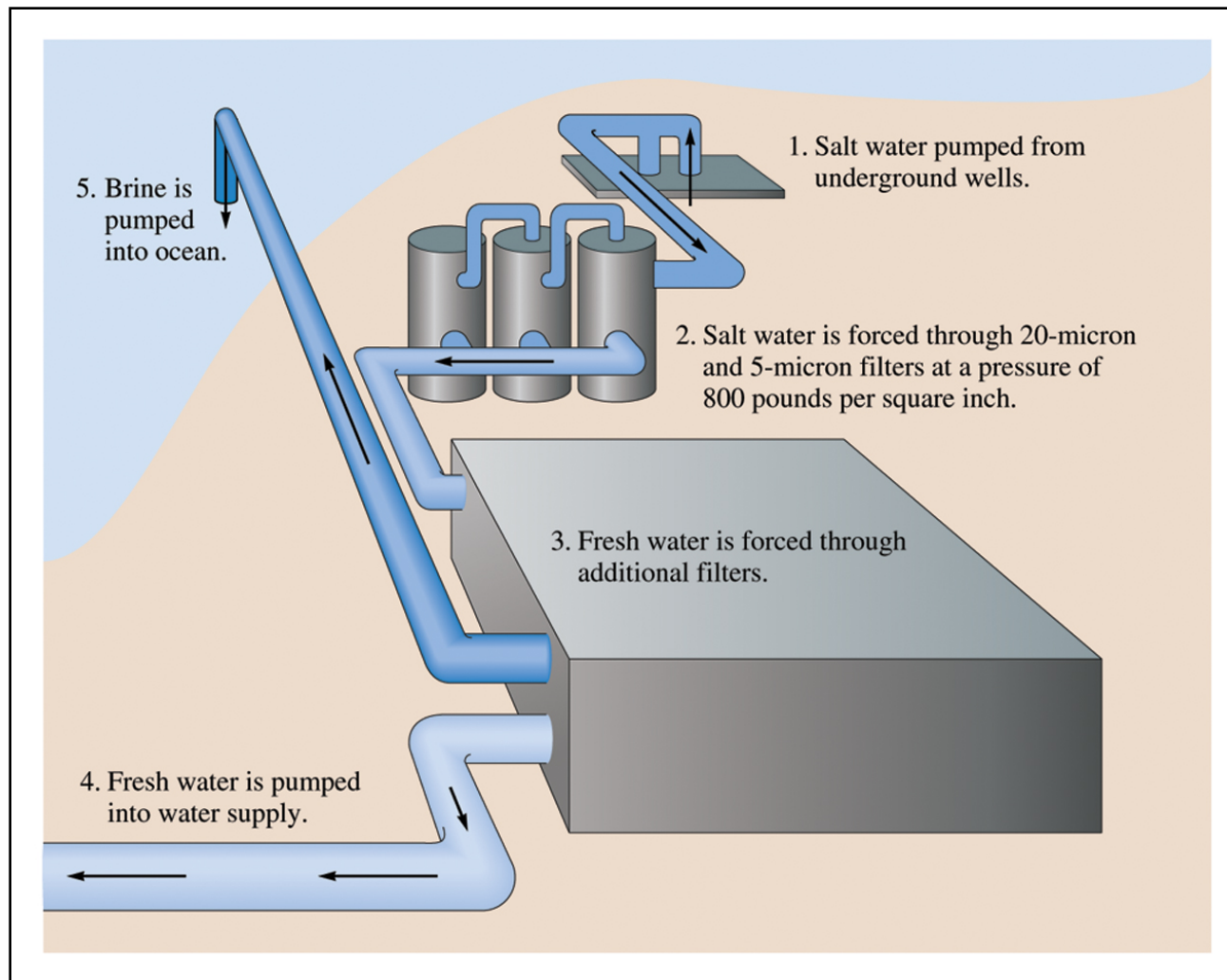


Table 11.7 Types of Colloids

Examples	Dispersing Medium	Dispersed Substance	Colloid Type
Fog, Aerosol	Gas	Liquid	Aerosol
Smoke, Airborne Bacteria	Gas	Solid	Aerosol
Whipped Cream, Soap Suds	Liquid	Gas	Foam
Milk, Mayo	Liquid	Liquid	Emulsion
Paint, Clay, Gelatin	Liquid	Solid	Sol
Marshmallow, Packing peanuts	Solid	Gas	Solid Foam
Butter, Cheese	Solid	Liquid	Solid Emulsion
Ruby Glass	Solid	Solid	Solid Sol

Figure 11.24 A Representation of Two Colloidal Particles

